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A comparative study of indigenous people's and early European settlers' usage of three Perth wetlands, Western Australia, 1829-1939

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A comparative study of indigenous people's and early European settlers' usage of three Perth wetlands, Western Australia 1829-1939

By

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BA (Hons)

This thesis is presented in fulfilment of the requirements for the degree of
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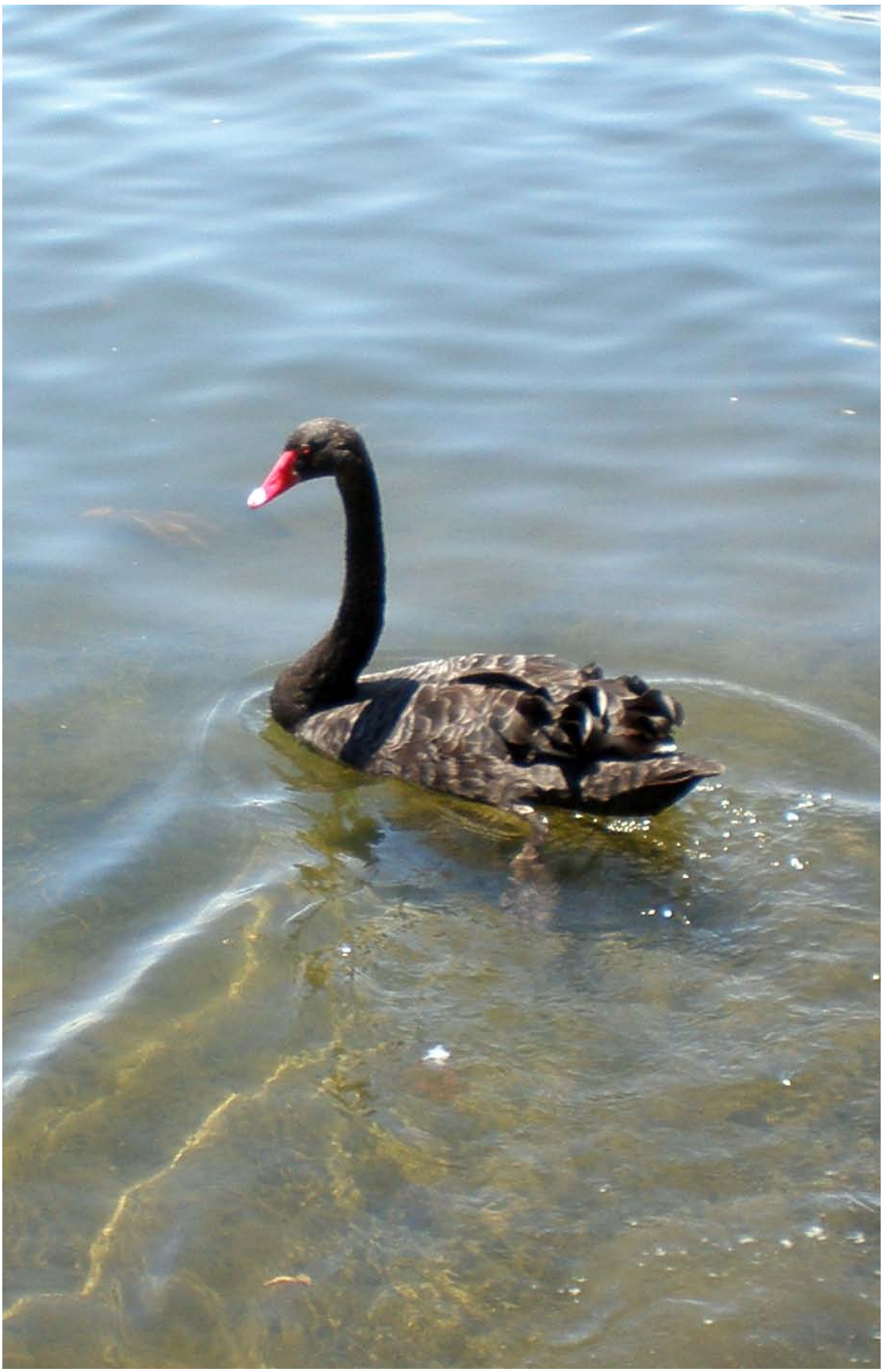

Abstract

This study takes as its focus the contrasting manner in which the Nyoongar indigenous people and the early European settlers utilised three wetland environments in southwest Australia over the century between 1829 and 1939. The thesis offers both an ecological and a landscape perspective to changes in the wetlands of Herdsman Lake, Lake Joondalup and Loch McNess. The chain of interconnecting linear lakes provides some of the largest permanent sources of fresh water masses on the Swan Coastal Plain. This thesis acknowledges the importance of the wetland system to the Nyoongar indigenous people.

The aim of this research is to interpret the human intervention into the wetland ecosystems by using a methodology that combines cultural landscape, historical and biophysical concepts as guiding themes. Assisted by historical maps and field observations, this study offers an ecological perspective on the wetlands, depicting changes in the human footprint on its landscape, and mapping the changes since the indigenous people's sustainable ecology and guardianship were removed. These data can be used and compared with current information to gain insights into how and why modification to these wetlands occurred.

An emphasis is on the impact of human settlement and land use on natural systems. In the colonial period wetlands were not generally viewed as visually pleasing; they were perceived as alien and hostile environments. Settlers saw the land as an economic commodity to be exploited in a money economy. Thus the effects of a sequence of occupances and their transformation of environments as traditional Aboriginal resource use gave way to early European settlement, which brought about an evolution and cultural change in the wetland ecosystems, and attitudes towards them.

Declaration

I certify that this thesis does not, to the best of my knowledge and belief:

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Chapter One:
Introduction

1.1 Background and objectives

A wetland may be defined as:

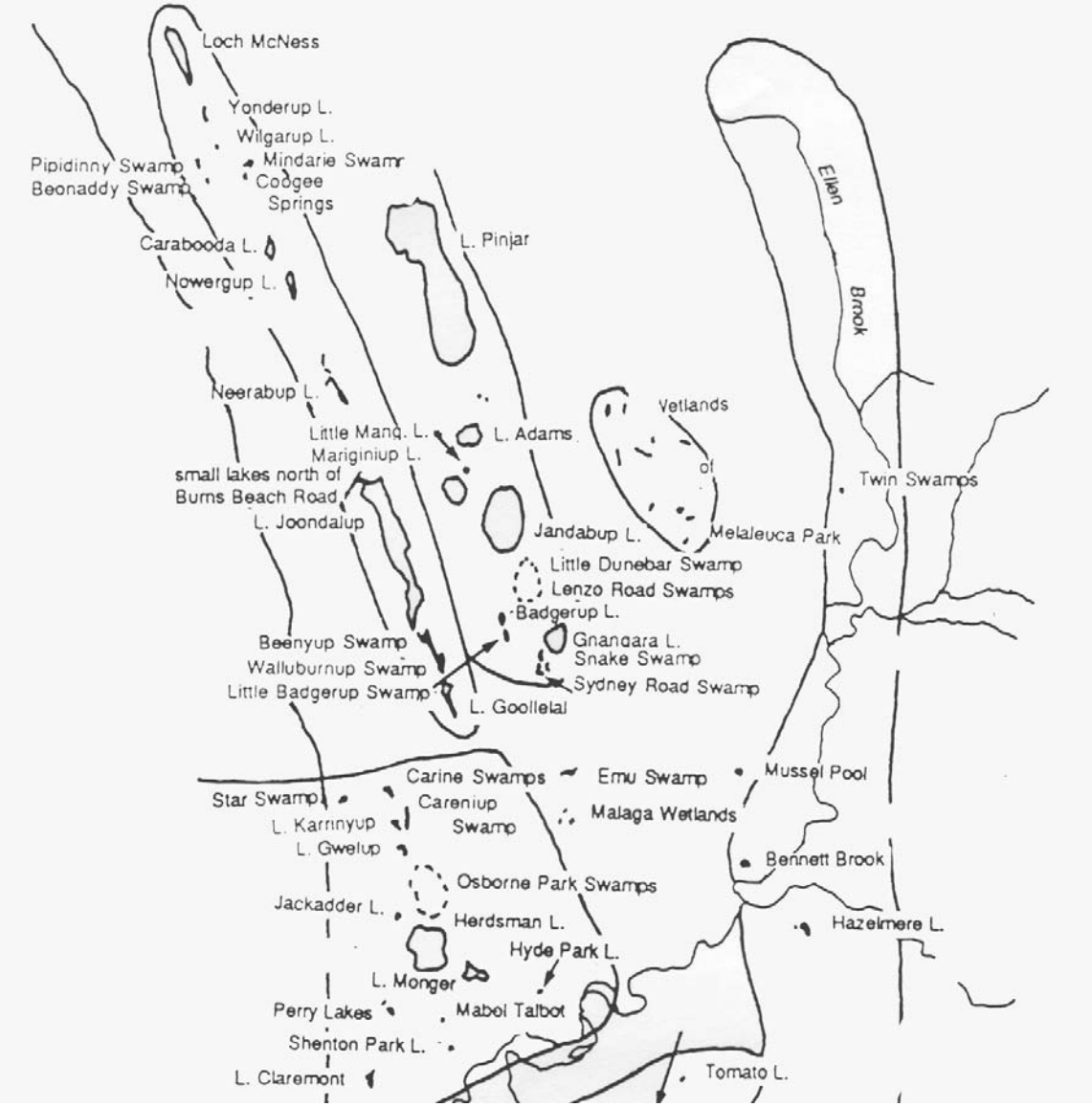
> An area that is permanently, seasonally or intermittently waterlogged or inundated with fresh or saline, flowing or static water. It includes areas of marine water the depth of which at low tide does not exceed six metres. (Environmental Protection Authority, 2007, p. 310).

Mitsch & Gosselink (1993, p. 4) describe wetlands as 'the kidneys of the landscape because of the functions that they perform in hydrologic and chemical cycles'. They have also been called 'biological supermarkets' because of the extensive food sources and rich biodiversity they support. Balla (1994) notes that wetlands are recognised as being the most biologically productive and diverse ecosystems. However, this changes over days, months and years, and also indeed over decades in response to seasonal climate cycles, storms and fires and human activities.

This study takes as its focus the contrasting manner in which the indigenous people and the early European settlers utilised wetland environments. It asks how and why human actions collectively, consciously or unconsciously, transformed the wetland landscapes in a chain of interconnected linear lakes extending from Herdsman Lake northwards to Lake Joondalup and Loch McNess at Yanchep near Perth, Western Australia (Figure 1).

The central theme of this thesis offers an ecological perspective on changes to Lakes Herdsman, Joondalup and Loch McNess. It recognises the importance of the wetland system to the Nyoongar[1] indigenous people, as the wetlands were used as camping and hunting sites for this group. There would have been no shortage of food as there was an abundance of wildfowl, turtles, frogs and fish. Moreover, 'Indigenous people saw the land religiously, as an intimate part of themselves and all life' (Broome, 1994, p.16).

[1] The spelling of Nyoongar varies (Nyungar, Noongar, Noongah). Indigenous people throughout Australia utilised a purely oral form of communication, resulting in various spellings. The Indigenous people of southwestern Australia are collectively ascribed as Nyoongar and they share a common culture, language, history and affiliation with their land.



Approx scale: 1cm to 12 kilometres ↑N

Figure 1: Chain of interconnecting linear lakes from Herdsman Lake northwards to Lake Joondalup and extending to Loch McNess at Yanchep.
Source: Adapted from Arnold, 1990, p. iv.

They had a sophisticated understanding of their land and were adapted to their environment. In contrast the early settlers saw the land as an economic commodity to be exploited in a money economy (Broome, 1994).

These wetlands provide an environment for assessment of the changes over time of the human footprint, particularly since the indigenous people's sustainable management and guardianship were removed. Indigenous people understood the ecological importance of these wetlands, and how they were an integral part of their total environment, and a valuable and essential element of the natural landscape (Hallam, 1975; Gentilli, 1998). McComb & Lake (1990) suggest the indigenous people

came to terms with the resources of their natural environment in a way that European culture could not emulate.

Since early European settlement, wetlands have progressively been filled or drained because they posed an obstacle for agricultural and urban development and were not recognised as being important, or of value. By examining the wetland study areas, it is possible to gain an understanding of how and why human intervention disturbed and displaced these natural landscapes and ultimately led to their degradation.

While indigenous people sustainably managed the land, this study attempts to show how the significant modification of these wetlands is the result of a succession of physical and social events that have occurred since early European settlement. It will be shown that the early settlers did not appreciate or respect the uniqueness of the Australian flora and fauna.

As the concept was understood by the early settlers, indigenous people had no sense of property. This misunderstanding allowed the settlers to utilise the land for their own purposes to the detriment of the traditional land and water users.

Green (1984, p. 54) discusses the differing views of land ownership:

> European man in common with Aboriginal man has a dependence upon the land for food, shelter, and clothing, but unlike the Aborigine he regarded land as an indication of wealth and status. Therefore he sought to own and exploit it to achieve his personal goals.

1.2 Significance and purpose of the study

This study will examine the attitudes of the indigenous people and the early European settlers usage of Herdsman Lake, Lake Joondalup and Loch McNess. By comparing these attitudes, it is possible to gain an understanding of how and why humanity has come to disturb and displace these natural landscapes.

Moreover, this research aims, for example, to demonstrate that wetlands and swamps are important ecosystems for a variety of reasons; they are essential breeding grounds for native birds, a summer refuge for trans-equatorial migratory wading birds, and a natural habitat for a unique flora and fauna.

It will be shown that the early cultural impacts of the landscape were the product of the indigenous people's practice of 'firestick burning' of the land (discussed in Chapter 4). This had the effect of flushing out game and rejuvenating plant growth. Hallam (1975, p. 15) in her publication *Fire and Hearth* writes: 'Aboriginal populations did change the vegetational and faunal balance. Fire was a major factor in this pattern

of regular exploitation and settlement'. The early settlers saw fire as a threat. It could destroy their homes, their crops, and it could destroy them (Kohen, 1995).

This study depicts the changing landscapes of these wetlands as they have evolved in response to natural processes and human activities. The principle aim is to identify, describe and analyse the natural and cultural transformations that have shaped these wetland landscapes. Lakes Herdsman, Joondalup and Loch McNess were important camping sites for the Nyoongar indigenous people. The Aboriginal's spiritual attachment with nature extended to the wetlands, which act as access tracks and trails providing camping sites for food and water. The indigenous people believed they shared the same life-essence with all the natural species and elements that live within their environment.

1.3 Previous studies

There is a plethora of studies on wetlands and the importance of these ecosystems and their ecological and structural diversity (e.g. Williams 1983; Congdon 1986; McComb & Lake 1990; Bekle 1992; Balla 1994; Giblett & Webb 1996; Gentilli 1998; Yenchen & Wilkinson 2000). In particular, there is literature available documenting the land use by the indigenous people of the southwest (Hallam 1975; Green 1984; Russo & Schmitt 1987).

These studies demonstrate how the first occupants, the indigenous people, utilised the land in an ecological sustainable manner for thousands of years (Bourke 1987; Kohen 1995). Hallam (1981) and Balla (1994) noted that before European colonisation, the indigenous people moved to the wetlands during summer and autumn. They chose to frequent localities and based their camps around wetlands where fresh water was available, and where an abundance of native flora and fauna was to be found.

Much of the published material that relates to the evolution of the cultural landscape originated from historical documentation, such as early settlers and explorers' diaries. Literature is also available documenting the land use by the early settlers' discussing how very few appreciated the ecological value of wetlands (Hallam 1981; Broome 1994; Giblett & Webb 1996). Early settlers cleared fringing vegetation and planted introduced species of shrubs and trees. They also brought with them cattle, sheep and horses from their homelands, which degraded much of the natural landscape (May 1994; Hallam 1998; Broome 2001). Loss and damage of fringing vegetation increased the potential for algal bloom to occur in the lakes. The attitudes of the early settlers, led to the progressive fragmentation of wetlands and their life support systems.

Local investigations must be considered in the context of global studies of wetlands (e.g. Gilman 1994; Azous & Horner 2000; Yenchen & Wilkinson 2000; Lindenmayer & Fisher 2006) as local sustainability impacts global sustainability.

1.4 Theoretical framework

This research aims to illustrate how the manipulation of natural and cultural landscapes altered the biodiversity of the wetland ecosystems. Discussion of the original natural landscapes reveals how the first forms of manipulation, by the indigenous people, were followed by colonial settlement, and more recently, urbanisation, a sequence of occupancy, which brought about an evolution and cultural transformation in the wetland ecosystems.

Geographers recognise that a cultural landscape is formed by continuous processes, and is not static. For example, Head (2000, p.3) suggests: 'that a cultural landscape is seen as one materially modified by people, a natural one is not'. Rubenstein (1989, p. 31) describes a cultural landscape as a 'heritage of many generations of human effort rather than entirely the product of contemporary communities'. Head (2000, p. 9) states: 'the issue is not to define cultural landscapes, but to consider the multiple ways in which the concept has been used'. The approach taken in my research on a set of cultural landscape can assist in the analysis of how natural and cultural transformations have evolved in the wetland ecosystems.

Importantly, 'a sequence of occupance' makes it possible to understand the interrelation of past landscapes and their transformations (Hallam 1975; Dingle 1988; Balla 1994; Aplin 2002). Butlin (1993, p. 198) refers to Whittlesey's publication (1926) 'Sequent occupance' which identifies 'each successive stage of occupation and settlement of a region as a reflection of the previous stage of occupation and contributor to the rest'. Rubenstein (1989, p. 32) also acknowledges sequence of occupancy by stating: 'each group, and in its turn, modifies the landscape in unique and characteristic ways'.

The concept of ecological sustainability[2] will be used to illustrate how the first occupants, the indigenous people utilised the land in a sustainable manner for thousands of years and was ecologically sustainable. Anthropologists Catherine and Ronald Berndt (1992, p. 137) wrote about the harmony and balance indigenous people had with their lives and the total environment:

[2] Sustainability involves the ability of a society, economy, population, ecosystem or environment to exist and function in the future much as it does now (Aplin, 2002, p. 21).

> They were intimately familiar with everything within it, and the life they led demanded that they should have this detailed knowledge. They also believed that they shared the same life-essence with all the natural species and elements within that environment. Their social world was expanded to include the natural world. Conversely, their natural world was humanized, and this was true for the land as such.

Indigenous people only took from the land what nature provided: therefore an ecological balance was maintained (Lofgren 1988; Bourke & Bourke 1994; May 1994). McComb & Lake (1990) suggest the indigenous people came to terms with the resources of their natural environment in ways in which European culture could not emulate. They gathered sufficient food for their immediate use, always leaving enough behind to ensure their propagation into the future: they managed their resources to good advantage (Lofgren, 1988).

The early settlers' rush to develop land for pastures and crops took precedence over conservation and environmental issues; this impacted on their evaluation of this new and unfamiliar environment. They brought with them a 'sense of place'[3] that originated in their homelands. These memories, experiences and understandings could not be easily transferred to the Australian landscape, which was to them strange and unyielding (Seddon, 1972).

During the early years of settlement, an early settler was moved to make the following odious comparison: (*The Swan River News* 11th August 1847 p 16).

> At home, a lake is known only as a sheet of water, which seldom or ever is dried up, and it is naturally associated in one's mind with pleasant and picturesque scenery but here it is quite different there is an air of desolation about these lakes, which strikes the spectator at once. It is complete still life without one point of interest in it, as far as striking scenery goes, and totally different from anything I ever saw outside Australia.

It is argued that the early settlers did not understand the complex interrelationship that existed between the indigenous people and their land. Indigenous land management was a systematic and well-managed use of the environment that had been refined through experience over thousands of years (May, 1994).

The historical approach to ecology seeks to interpret ecological information from historical sources. Williams (1974, p. vii) noted:

[3] A 'sense of place' shows most clearly in the way the community feels about and uses the landscape (Seddon, 1972, p. 262).

> One cannot understand the landscape of the present without going back to the history that lies behind it, a process which also lends both perspective and insight into current modifications, which are occurring with ever increasing speed and impact.

Bekle (1981, p. 2) also noted the importance of historical approaches to wetland ecosystems in the Perth region, he stated:

> In the analysis of historical data, there is a case for an ecological viewpoint, in which the history and ecology of a particular environment are reviewed, and an attempt is made to structure and dynamics of the ecosystems of the past.

By providing an explanation of human intervention it is possible to understand the contrasting manner in which the indigenous people and the early European settlers utilised the wetland ecosystems (Gilks 1977; Hallam 1975; Balla 1994; Erbacher & Erbacher 1998; Gentilli 1998). The concepts of expansionism and the lack of environmental awareness will be discussed to illustrate the absence of the early settler's ecological knowledge in relation to the wetlands.

This research thus resolved itself into a number of 'research questions'.

1. Is it possible to identify a sequence of occupances and land use in these wetlands?
2. How did the attitudes of the indigenous people compare with those of the early European settlers?
3. How did the use of the wetlands by the indigenous people and the early European settlers compare?
4. What were the significant changes to the wetland environment over the centuries before 1839 and 1939?
5. What can be learnt from traditional indigenous land use in term of sustainable practice?

Chapter Two:
Methodology, Sources and Research Techniques

There exists a long and intimate relationship between people and their natural environment and a methodology was adopted that was able to elucidate the complex relationship between nature and culture in these wetland landscapes. This chapter examines how these data were collected and analysed.

2.1 Archival sources

Archival information yields a multitude of observations, as well as opinions and assessments, which can be used to interpret and develop a chronological ecological perspective. These data can be used and compared with current information to gain awareness into how and why modifications of these wetlands occurred.

Some aspects of the traditional management practiced by the indigenous people were described and discussed by early explorers and early settlers and might provide insights for contemporary sustainable management (discussed in Chapter 4).

The writings of early explorers such as Lieutenant George Grey, and Advocate General George Fletcher Moore, offer some of the earliest descriptions of the Swan Coastal Plain landscape. Grey (1841, vol, 2. p. 296) defined the nature of the landscape in terms of the resources available to the early European settler: 'I saw some very good land…plenty of good feed for cattle'. He also described the abundance of wild ducks and noted: 'I shot a brace of wild ducks…part of these we cooked and kept the remainder for our dinner. I forgot to mention that we yesterday shot twelve parakeets'. Moore (1884, p. 34) also gave an account of how he caught his next meal: 'this day I shot a duck: there are two kinds of them; one of which, the wood duck [*Chenonetta jubata*], alights on trees'. Diaries make interesting records of the journeys of the past traveller; seasonal patterns and general trends can emerge. The records of early settlers, travellers and explorers have to be seen as observations of the landscape through the lens of their own upbringing and outlook of their society.

2.2 Published research

Academic literary sources illustrate the writings and research of published and non-published academic books, paper and publications. These sources are an essential starting point for this study. Academic writings can be utilised to gain an insight into chronology. Writers and researchers such as Hallam 1975, Bekle 1982, and Gentilli 1998, testify to the fact that European settlement led to the degradation of wetlands and

their supporting ecosystems in the study areas, as well as other wetlands throughout Australia.

2.3 Photographs

Old photographs located in archival deposits and council libraries, and in the Battye Library, Perth, can provide pictorial evidence of the sequence of events in the study areas. Visual impressions are particularly useful when comparing and contrasting a former situation with the modern environment. For example the changing pattern of land use in the Joondalup area is illustrated in photographs that are included here.

Figure 2: A typical market garden near Lake Joondalup in the 1900s.
Source: Joondalup Reference Library 943.

Note: It appears to be a family affair with all members contributing to the growing of vegetables. The gentleman on the right can be seen watering by hand. Note grass paths dividing the various plots.

Figure 3: Cattle grazing on the shores of Lake Joondalup. c.1920.
Source: Joondalup Reference Library P00647.

Note: Fence line on edge of the Lake, which enables cattle to feed and graze close to water. However, this led to the degradation of the shoreline.

The author has taken a number of photographs for comparison with older images of the study areas. In the case of such photographic comparisons the date and time were recorded in order to make valid analyses, allowing for different seasons and time of day.

2.4 Aerial photography

Aerial photography reveals, with considerable accuracy, changes in plant communities, land use and the encroachment of urbanisation. Ideally both maps and aerial photography should be used together to reveal the changing extent of water coverage and vegetation structure. Unfortunately, for the purpose of this study, aerial photography did not commence until the 1940s. However, recent aerial plates of the study areas are included in the Appendices (1) show the progression of urbanisation encroaching onto the wetlands.

2.5 Historic maps

Lilley (2000, p. 370) suggests that the aim of map interpretation offers 'a way of connecting with landscape, and those who shape it'. Gentilli (1979, p. 506) noted: 'vegetation maps show all or part of the collective plant growth over an area. They are concerned with the live matter, or biomass, and its gross structure; he also suggests floristic maps show the geographical distribution of one or more plant species'.

A set of old maps arranged in chronological order reveals the sequence of settlement patterns, they may show changes in flora, fauna and land use, as well as the progressive sub-division of the study areas. However, early maps featuring European terminology may provide misleading information as different names of plants may be used e.g. 'mahogany' (jarrah) (*Eucalyptus marginata*) and 'tea tree' (paperbark) (*Melaleuca raphyiophylla*). Different problems include that such maps may be fragile or partly illegible. Old maps are useful as they illustrate the irreversible damage to the environment caused by the early European settlers and subsequent development.

For example: *Swan Location Locations-Rough Sketch of Lake Joondalup* dated 1841-1846 located in the State Records Office, Perth, already shows the land being subdivided into large blocks for agriculture and grazing (Figure 4). Maps can also reveal different spelling of place names e.g. according to A. L. Lewis' survey map of 1898, Herdsman Lake was named *'Ncoorcenboro'*. However, the indigenous people called the Lake *'Ngurnboro'* (Figure 5) (discussed in Chapter 6).

Maps in explorers' field notebooks are extremely important sources of information allowing comparisons with present day landscape. They often provide an economic interpretation of the land, recording the availability of good grass for pasture, fresh water for livestock and distinctive landmarks. However, the descriptions vary in the degrees of detail and accuracy shown. 'The initial objective of surveying land was to facilitate its use by settlers' (Bekle, 1981, p. 6). For example Surveyor John Septumus Roe's drawing of Lake Mambibby (now known as Loch McNess) and surrounding areas on 21st May 1841, describes in detail the terrain of the area. Observing good land for sheep feed, and extensive open downs with good grass. Therefore, suggesting promising economic prospects for future settlers. He had a 'modern' surveyor's scientific approach in that he records his directions and distances carefully (Figure 6).

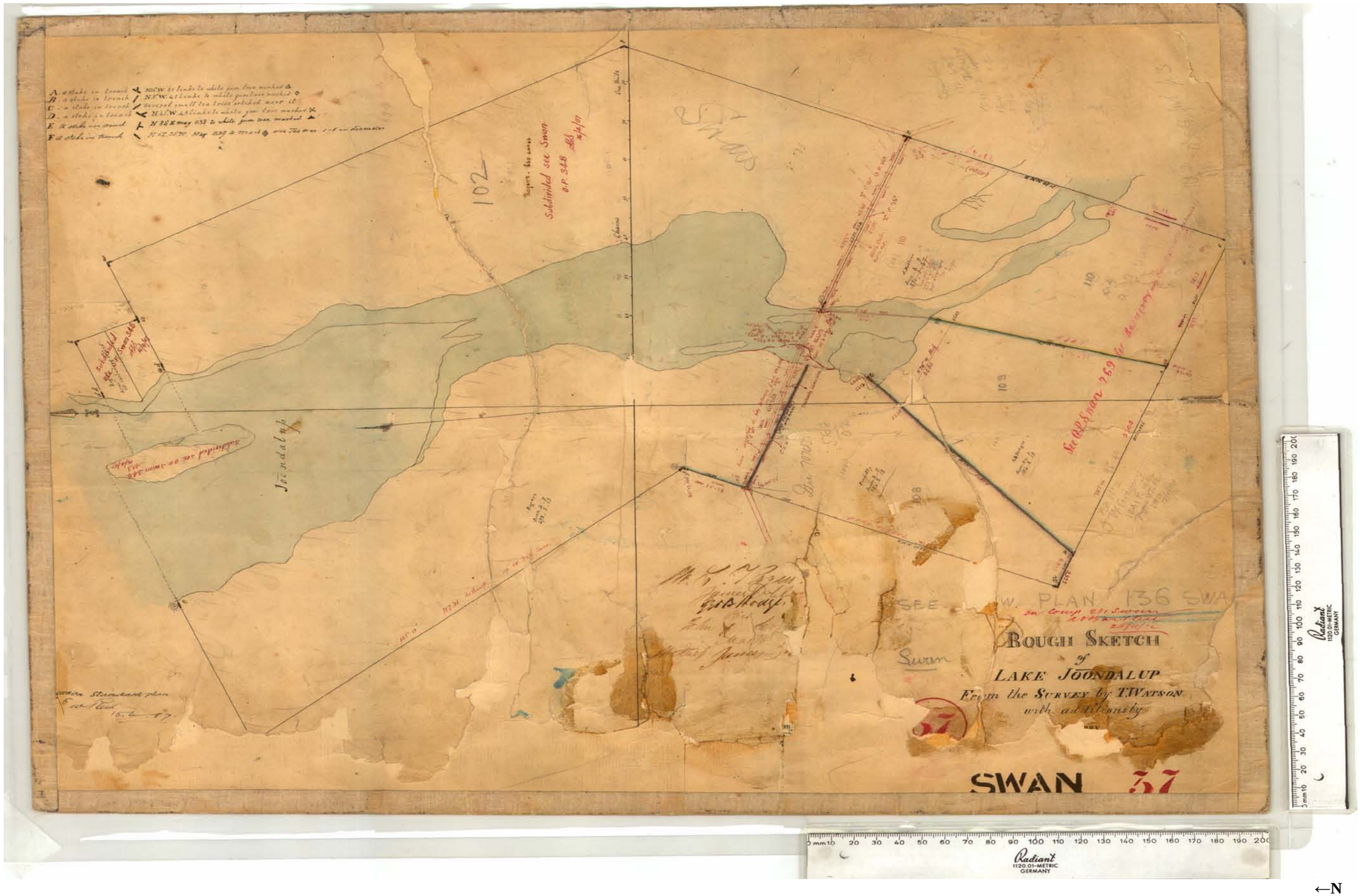


Figure 4: Swan locations – rough sketch of Lake Joondalup from survey by T. Watson with additions by J. Gregory 1841-1846.
Source: State Records Office of Western Australia.

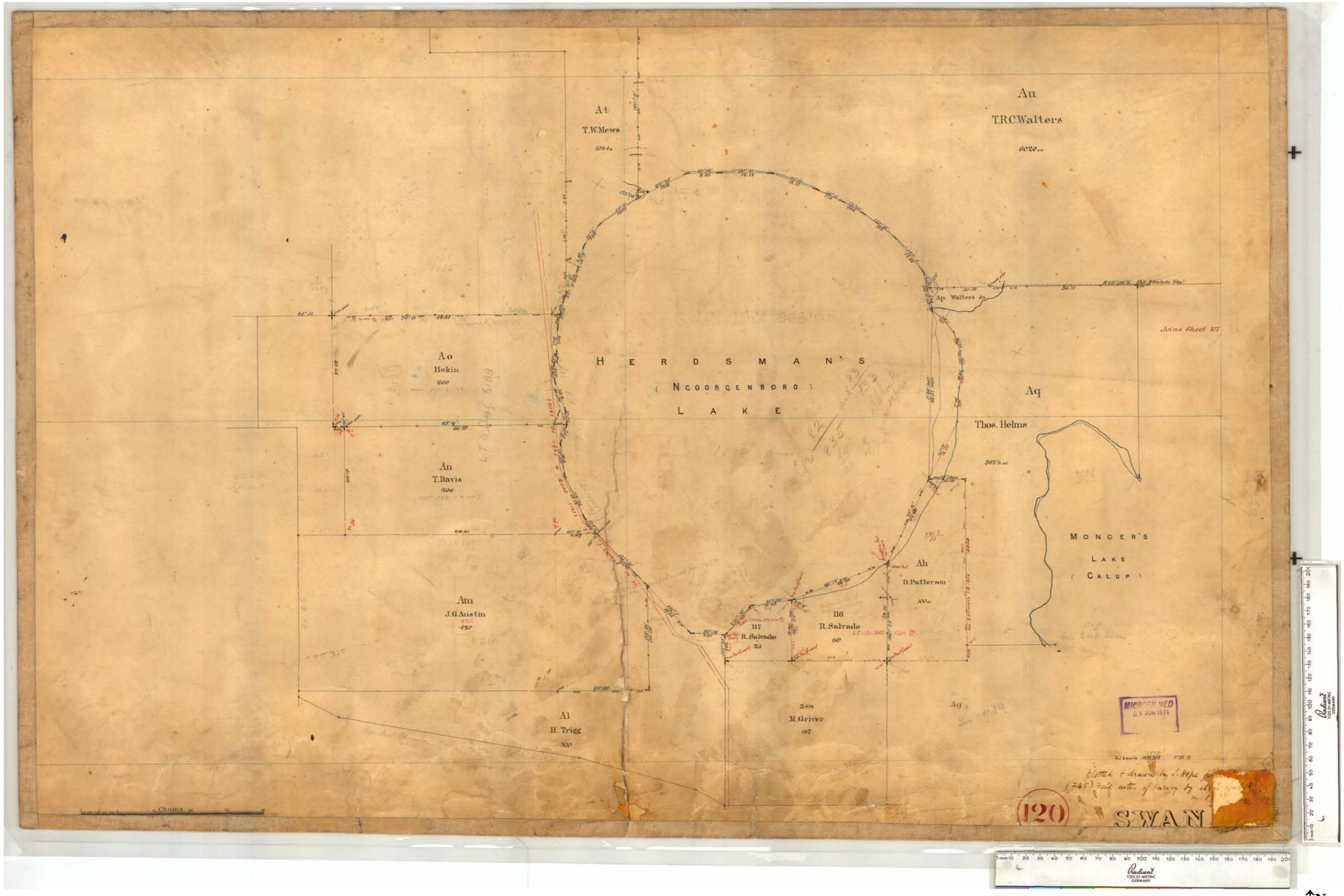


Figure 5: Survey by Assistant Surveyor A.J. Lewis of Herdsman's Lake 1898.
Source: State Records Office of Western Australian.

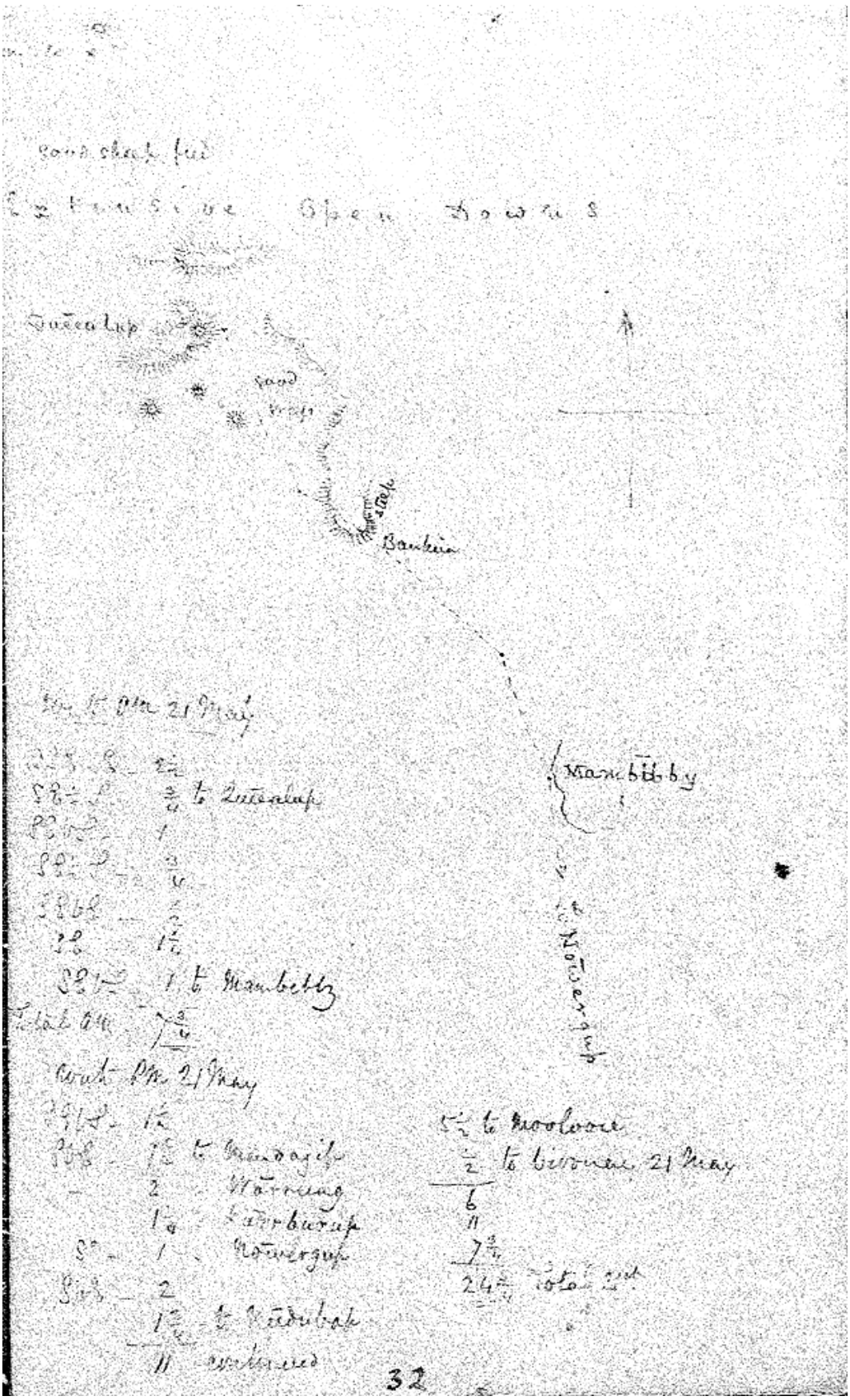


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Figure 6: Detailed description of Lake Mambibby (now known as Loch McNess) and surrounding area by Surveyor General John Septumus Roe 21 May, 1841.
Source: State Records Office of Western Australia.

2.6 Newspapers

Old newspapers can be used to reconstruct past ecological changes and illustrate the problems early European settlers experienced. For example *Perth Gazette, Inquirer, Stirling Times, The Swan River News and Inquirer and Commercial News* (approximate date 1840s) printed information on problems early settlers experienced. Settlers used newspapers to communicate with each other in Letters to the Editor, in which they described the difficulties in understanding and adapting to the Australian landscape and the unfamiliar climate. They reported difficulties in selling produce and the need for information on exporting and importing goods. Articles in newspapers also contained early environmental opinions and information regarding their crops and tips on how to raise crop production, as well as information on wildlife. Early newspapers, especially the *Perth Gazette,* also kept the more isolated settler in contact with the rare social events. Horse racing was one of these great and popular occasions (Green, 1984).

The use of fire in indigenous land-use and lifestyle caused many problems for the early settlers: advise for settlers were given in *The Inquirer* 14th April 1841:

> The thatched hut may be erected sufficient to afford temporary shelter, the bush thoroughly cleared, and during the dry season, the grass burned off within a circle of 50 yards to secure the property from fire; great precaution being used to prevent its spreading and then the land should be immediately cleared for the plough.

Newspapers were also used to inform the public of land and property for sale or rent. For example:

To Be Let Notice

> A desirable Freehold Estate between Herdsman and Mongers Lakes, now in the occupation of Mr. Helms. To an industrious, sober man with a family, accustomed to farming, and whose wife can manage a dairy, this property offers the means of making a profitable home (*The Inquirer* April 26th 1843).

The money-based agricultural economy was clearly well established only 14 years after the first European settlement.

Here is a notice from the Colonial Secretary's Office in the *Perth Gazette* 23rd (February 1833) advising settlers to show discretion in encouraging and supplying the local indigenous people with presents. If published today this article would be considered inappropriate:

> The local Government having made arrangements, through the Superintendent of Native Tribes, for bringing about a friendly understanding with the natives, and supplying them with presents (bread and rice) at Mongers Lake: the inhabitants of Perth are hereby cautioned from encouraging their coming into town or giving them food, as such kindness will in great measure retard, if not wholly frustrate, the objects contemplated (Peter Brown. Colonial Secretary, 18th February 1833).

2.7 Published diaries and letters

George Fletcher Moore, Advocate General of the Swan River Colony, recorded daily events of early settlement in his diary. With a striking realism he illustrates the early life of the settlers and the progress of the Swan River Colony. Expressing great pleasure in viewing the gradual 'improvement' of the landscape he wrote:

> Now midst the desert, fruitful field anse,
> That crown'd with tufted trees and springing corn,
> The forest wonders at the unusual grain,
> Like verdant isles the sable waste adorn;
> And sweet transports touch the conscious swain.
> (Moore, 1884, p. 117).

However, describing the picturesque landscape surrounding his newly built house he appears to yearn for his homeland and friends, expressing a longing: 'It reminds me of the Thames near Richmond, and it sometimes looks not unlike *home*, and might feel so too, if my friends were with me'. He also replies to friends anxious to know whether he recommends emigration to Perth replying: 'If persons cannot remain comfortably at home, I would recommend this place in preference to Sydney, or Van Diemen's Land'. He continues, writing:

> How often I wish that some of you were here! For this wild life although it has its inconveniences, has its pleasures too. I'm sure you would enjoy it, if once the roughing was a little over. I have had a great feasting upon fresh meat (fowls) every day for some time for myself and people: to-day I had at dinner a very large pigeon; yesterday, a brace of wild ducks; and the day before a brace of parrots, and so on besides greens and radishes (Moore, 1884, pp. 30-40).

This illustrates the ambivalence of the settler to the environment but his enthusiastic outlook to the new country.

2.8 Oral histories

To gain a human perspective of the study areas, oral histories from local people and long term residents provided a source of historical facts of past events that no other

form of historical data can. However, although this valuable information can provide impressions of past events it is important to note that inaccuracies in memory are not infrequent and therefore facts and figures require confirmation from other sources. Early settler Carmelo (Agnello) Grinceri 1891-1964 recalled her experiences:

> When we came to Australia there was nothing, it was all bush, all desert. Wanneroo Road was made of wooden stumps; there were no roads, and no houses. We lived in houses made of bags, when the wind blew it would take everything away.
> (Personal communication, utilising oral sources [John Grinceri, 2003].

2.9 Fieldwork

Field verification of past and present ecological changes formed an important part of my study e.g. evidence of old fence lines taken during winter (Figure 7) and summer months (Figure 8). Bekle (1981, p. 5) 'Field observations can supply information of both historical and ecological value, by providing a link between historical documents and the contemporary landscape'. For example, Captain James Stirling made his inspection of the Swan River in March, when the days were warm and the landscape full of colour. However, early European pioneer settlers who came in July, when the days were bleak and cold, and the land forbidding were disillusioned (Landor, 1847). Fieldwork was conducted to photograph the study areas and examine historical sites e.g. Herdsman Lake, Lake Joondalup, Lake Goollelal, Beenyup and Walluburnup Swamps, Yanchep Caves and Loch McNess; this information will be discussed during the course of this study.

Figure 7: Lake Joondalup old fence lines during summer months.
Source: John Birch 2010.

Note: The clearing of native vegetation around the lake was manipulated to suit human settlement. Early European market gardeners cultivated the wetland bed.

Figure 8: Lake Joondalup old fence lines during winter months.
Source John Birch 2010

Note: The lush green vegetation is ideal for water bird habitat and refuge. Black Swan (*Cygnus atratus*) in the foreground. Great Egret (*Egretla alba*) on the reed bed foraging for food.

Chapter Three:
Physical Landscape

3.1 The study area

Captain Irwin (1835, p. 5), one of the leaders of the Swan River Settlement in 1835, described the land around Perth:

> The country near the coast generally presents either an open forest, plains covered with short brushwood mixed with grass, or open downs. Numerous lakes, fresh and salt, extend along the coast, as do also hills and ridges of calcareous formations… A great variety of flowering shrubs cover the country in many parts, and occasionally, lofty trees with wide-spreading branches embellish its surface.

George Fletcher Moore (1884, p.31) describes the general character of the Swan Coastal Plain as an: 'Interesting landscape, rather than a sublime or grand scenery. There is every variety of soil from white sand to deep black vegetable alluvial mould'.

3.2 Geographical setting

The Swan Coastal Plain is the most southerly of the three geomorphic subregions of the Swan Coastal Belt as delineated by Gentilli & Fairbridge, cited in McArthur & Bettenay, (1974). It extends for 565 kilometres from near Geraldton in the north, southwards to Dunsborough. 'It is bounded on the east by the Darling Fault, on the north by a subsidiary fault running north-west from Bullsbrook, and on the south by the Collie-Naturaliste scarp' (McArthur & Bettenay, 1974, p. 4). 'The area involved is about 40 000 square kilometres and extends from latitude 31° 30' to 35° 30'S, with a mean longitude of 116° 50' E' (Balla, 1994, p. 166).

The Swan Coastal Plain 'has been homogenous in its geology over the last 65 million years, and in its soil, its climate and its vegetation is "a natural landscape". It is made up of two wide belts of sediments that differ in origin. One has been accumulated by wind -'aeolian'-, and the other water-laid-'alluvial'. The aeolian sediments are to the west of the Coastal Plain and the alluvial sediments in the east (Seddon, 1972, pp. 3-7).

As previously discussed, Lakes Herdsman, Joondalup and Loch McNess form part of a chain of interconnecting linear lakes that extend parallel to the Indian Ocean in the Spearwood Dune System. These lenthic wetlands provide some of largest permanent sources of fresh water on the Swan Coastal Plain and are directly associated with the underground water table (Gnangara Groundwater Mound) a feature of great importance to Perth's water supply.

The landforms within the study areas are similar to features as found elsewhere on the Swan Coastal Plain. They were formed from large sand dunes that overtime have become consolidated and stabilized with vegetation. 'This Quaternary dune system corresponds to the geomorphic element of permeable aeolian sands known as the Spearwood Dune System' (Upton & Kinnear, 1997, p. 7). The natural environment is thus characterized by gently undulating landforms of parallel sand dunes with intervening valleys or depressions, some of which contain wetlands (Gentilli, 1998; Seddon, 2004). The Coastal Plain slopes gently westwards from the Darling Scarp to the Indian Ocean. The landform is known as the Dandaragan Trough, which is the deepest subdivision of the Perth Basin (Department of Conservation and Land Management 1989-1999). However, the landforms, rocks and soils surrounding Loch McNess are more varied and complex, consisting mainly of sand and karst features (Seddon 2004; Gentilli 1998).

3.3 Landforms

Three sediments deposited as a series of landscape units parallel to the present coastline cover the Swan Coastal Plain. These include the Quindalup Dunes, which are closest to the coastline, the Spearwood Dunes; and the Bassendean Dunes.

3.3.1 Bassendean Dune System

The Bassendean Dune System is the most easterly and the oldest of the three dune systems and formed close to the sea tens of thousands of years ago. 'It is the most heavily leached, and consists of between 1.5 and 3 metres of grey to white sand overlying an orange-brown layer and another layer of white sand' (Guy; Kalajzich & Nelson 1995, p. 44). The soils have a low agricultural potential.

3.3.2 Spearwood Dune System

The Spearwood Dunes are the surface expression of the Coastal or Tamala Limestone: they are located west of the Bassendean System and separated by a line of swamps and lakes. They were formed some 40 000 years ago (Guy *et al*, 1995). McArthur & Bettaney (1974, p. 13) noted: 'This element consists of a core of aeolianite with a hard capping of secondary calcite overlain by variable depths of yellow or brown sand'. The Spearwood System is associated with the Cottesloe soil associations to the west and Karrakatta to the east. Although the soils are infertile, with heavy fertilizing it is possible to grow vegetables and flowers. In much of the Spearwood dune system, the underground water can be tapped by shallow bores, and until urbanization the area was

used extensively for market gardening around Lakes Joondalup and Goollelal (Seddon, 2004).

3.3.3 Quindalup Dune System

The Quindalup Dune System was formed during the Holocene Period (less than 10,000 years Before Present) and consists of recently deposited calcareous sands. There is some cementing (lithification) in the lower layers of the older phases of the system, towards formation of aeolianite limestone (Churchward & McArthur, 1980). 'It forms the edge of the present coastal strip and is up to 4-0m high and 1-3 km wide in the southern Swan Coastal Plain' (Balla, 1994, p. 12).

3.4 Climate

The Swan Coastal Plain experiences a typical Mediterranean climate, characterized by dry, hot summers and mild wet winters. The Perth region has the highest number of hours of sunshine per year of any Australian capital city (Riggert, 1978). During summer, the high-pressure systems produce hot, strong, easterly winds drawn from the interior of the continent consequently, relative humidity is low. During the winter months, winds are predominantly from the southwest and humidity and rainfall totals were high (Clarke; Davis; Murray, 1990). The average January temperature of the Swan Coastal Plain is 28.8^{o} C with a July temperature of 13.2^{o} C (Snell, 2008, p. 35).

However, the extreme summer temperatures are likely to be higher at Loch McNess where vegetation is less dense and because of the more open landscape, and humidity is likely to be lower than in Perth (Gentilli, 1998). The overheating of the land in the region gives rise to a sea breeze named by the early European settlers the 'Fremantle Doctor' (Seddon, 2004).

The water for the wetlands is derived from rainfall; this also presents a significant addition to the wetlands' nutrient balance. Ninety per cent of the annual rainfall falls between April and October; this replenishes the lakes and swamps during these months (Congdon, 1986; Department of Water, 2008).

The size and depth of water in the Swan Coastal Plain wetlands changes with fluctuations in rainfall from year to year, and over decades. However, the water balance is also affected by direct evaporation, which occurs from soil, transpiration from vegetation (mainly through leaves) and loss from the water bodies themselves. The annual variation in groundwater and wetland water levels can be several metres. This

changes the distribution of the wetland vegetation, altering the character of the wetlands and the way animal and plants respond (Balla, 1994).

3.5 Hydrology

The wetlands of the Swan Coastal Plain are not uniform in character. 'There are clusters of wetlands that have similarities because of the underlying soils, the landforms or hydrology'. 'The hydrology of a wetland is determined by whether water is permanent or seasonal or only present intermittently, how much water is present, where it comes from and where it goes'. There are two broad types of wetlands that differ in their hydrology. 'Those with flowing water or lotic wetlands (rivers, creeks, estuaries and drains) and those with still water or lentic (lakes, swamps and damplands)' (Balla, 1994, pp. 15-17).

The differences physical and chemical between these two wetland types mean that they produce different plant and animal communities. For example, plants that grow in lotic wetlands need to be strongly rooted to withstand the strong current that passes over them and many animals use the flow of the water to filter out food. Animals that live in lentic wetlands move about more freely because they do not have to protect themselves against the flow (Balla, 1994).

The greatest source of surface water for lentic wetlands for the Swan Coastal Plain is derived from direct infiltration of rainfall; mostly between the months of April and October 'These wetlands overlie unconfined aquifers, which may locally form mounds of groundwater' (Balla, 1994, p. 15).

To the north of the Swan River is the Gnangara Groundwater Mound[4] it extends over an area of 2091 square kilometers and is so named because the aquifer forms a mound beneath the land surface, which rises to approximately seventy metres above sea level. It extends from the Moore River in the north; Ellen Brook in the east; the Swan River in the south; and the Indian Ocean to the west. Recharge of the aquifer primarily occurs in the winter months as rainfall seeps through the soils to become part of the Gnangara Groundwater Mound system. South of the Swan River is the Jandakot Groundwater Mound which is the smaller of the two (Balla, 1994).

[4]It is so named because the aquifer forms a 'mound' beneath the land surface, which rises to approximately seventy metres above sea level. Recharge of the aquifer primarily occurs in the winter months as rainfall seeps through the soils to become part of the Gnangara Groundwater System (Department of Water, 2008).

The climate of a locality is the most significant aspect influencing the development of soils. The combination of different rainfall and temperature conditions produce a variety of soils. Hot wet climates produce weathered and leached soils. Climates that are hot and dry create thin granular soils (Snell, 2008).

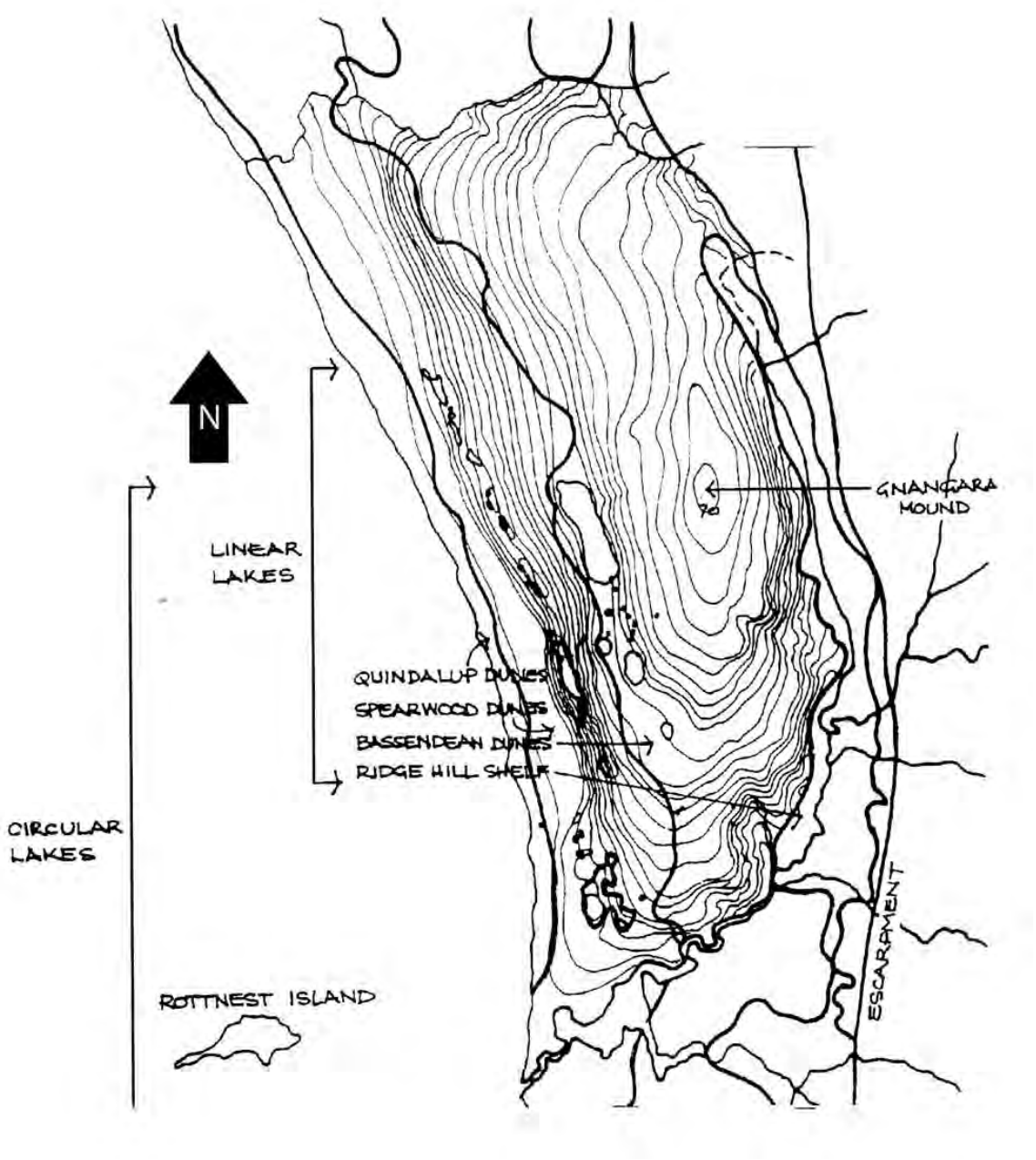

Figure 9: Gnangara Groundwater Mound System.
Source: (Brittain 1990, p. 15).

Note: To the north of the Swan River is the Gnangara Groundwater Mound it extends over an area of 2091 square kilometres from Moore River in the north; Ellen Brook in the east; the Swan River in the north; and the Indian Ocean to the west.

3.6 Soils and vegetation

The types of soil present in the study areas are:

- Cottesloe Soil Association
- Karrakatta Soil Association
- Beonaddy Soil Association

3.6.1 Cottesloe Soil Association

The Cottesloe Soil Association consists of shallow yellow and brown neutral soils over limestone out crops, and lies to the west of the Karrakatta Soil Association. Collectively they are known as Spearwood sands (Gentilli, 1998; Seddon, 2004).

3.6.2 Karrakatta Soil Association

The Karrakatta Soil Association consists of deep leached yellow and brown sands overlying limestone, which is usually found within three metres of the surface.

3.6.3 Beonaddy Soil Association

Between Beenyup and Walluburnup swamps there is a fringe of Beonaddy sand. This has a dark grey surface layer, becoming lighter at a depth, with brown mottling caused by decayed infiltrated humus. It is to be found in low-lying areas adjacent to lakes and swamps (Heddle, 1980; Upton & Kinnear, 1997).

3.7 Vegetation communities

The vegetation in and around the wetlands of the study areas has been subjected to alteration from the time of early European settlement. (This will be discussed in Chapter five.) However, at the present time there still remain some vegetative communities that were adapted to the Spearwood Dune System. They represent those once widespread on the Swan Coastal Plain before European settlement.

As stated by Seddon, (1972, p. 110). 'There are only eight really common trees on the coastal plain, three of which are eucalypts, the tuart, marri, and jarrah (*Myrtaceae)*; three are banksias (*Proteaceae*); one is a casuarina (*Casuarina fraserian*)*)*; and one a wattle (*Acacia cyanophylla*).

Amongst the dominant canopy species in the plant communities of the area are the following:

- Jarrah (Eucalyptus marginata);
- Marri (Eucalyptus calaphylla);

- Tuart (Eucalyptus gomphocephala);
- Swamp Banksia (Banksia littoralis) and
- Paperbark (Melaleuca raphyiophylla) and Flooded Gum (Eucalyptus rudis).

Eucalypts are Australia's largest trees and are commonly known as 'gum trees'. They dominate the vegetation, and constitute the main trees in providing wildlife habitat. Many mature specimens provide shelter for a variety of animals. The indigenous people utilised the oil from eucalypt leaves to make medicine.

3.7.1 Jarrah association

Jarrah (*Eucalyptus marginata*) is the best known of Western Australia's eucalypts and is the dominant eucalypt on the Karrakatta Soil Association. It occurs where soils overlying the limestone are at their deepest. Having an extensive, deep root system it can penetrate the soils to reach groundwater, making it resilient to the drier conditions (Snell, 2008). During the nineteenth century it was known as Swan River mahogany, and valued as a cabinet wood. The timber was exported from the earliest days and between 1898-1904, jarrah exceeded wool in export value (Seddon, 2004). Many of the trees have survived for more than three hundred years and are therefore 'a link with the indigenous landscape' (Seddon, 1972, p. 120).

3.7.2 Marri association

Marri (*Eucalyptus calaphylla*) is found as a small tree or shrub along the northern and eastern limits on the coastal plain. It is most widespread on well-drained wetter soils of the coastal region and is considered by farmers as an indication of relatively good agricultural land. The marri grows in water during the winter, but above the water line in the summer months. During early European settlement it was used as road making material. It is known for its toughness, durability and resistance to termites, which makes it ideal for fences, floors and furniture (Seddon, 2004).

3.7.3 Tuart association

Tuart (*Eucalyptus gomphocephala*) woodlands have adapted to the sandy calcareous soils near coastal locations. 'The root system extends down to tap the shallow ground water supplies beneath the sandy ridges and plains on which it grows' (Snell, 2008, p. 41). It is often found in association with marri and jarrah. The understorey commonly has the grass tree, (*Xanthorrhoea preissi*), and zamia palm,

(*Macrozamia riedlei*) (Gentilli, 1998). The tuart is the only large tree wholly restricted to the Swan Coastal Plain and found in a long narrow belt along the coastal limestone.

3.7.4 Flooded gum

The flooded gum (*Eucalyptus rudis*) is able to endure prolonged flooding and thus is mainly found in waterlogged areas. It is common as fringing woodland around many lakes and swamps (Seddon, 2004). The flooded gum in prolific around Herdsman Lake.

3.7.5 Swamp paperbark

Swamp paperbark (*Melaleuca rhaphiohylla*) grows in water during winter months, but above the water line in the summer months as the level falls: it is common as riparian fringing woodland around many swamps and lakes, wherever there is an abundant water supply (Seddon, 2004). Swamp paperbark 'earlier known as tea-tree (or ti-tree) from the colour of the water stained by its leaves' (Bekle, 1998, p. 250). The leaves produce chemicals that impede the growth of other species and thus the ground under the paperbark is often devoid of other species of plants (Armstrong, 1998). A mature tree with its rounded canopy offers a suitable location for bird roosting and nesting, while its close canopy provides a safe haven from birds of prey (Bekle, 1998).

3.7.6 Wetland vegetation

Wetland plant communities are central to all wetland processes. 'Vegetation is adapted to inundated or waterlogged conditions that often form overlapping zones along an elevated gradient from deepest part of a wetland' (Balla, 1994, p.166). The wetland vegetation occurs in specific areas, which may include fringing paperbark woodland, sedge and rush communities and open water communities. These provide habitats for a range of aquatic and terrestrial fauna and constitute the primary production that is the basis of all wetland food networks. Many native fauna depend on permanent water to survive during summer droughts.

Fringing vegetation is of particular importance as it stabilises and aerates the sediment, thus providing a filtering mechanism for material passing into the wetland (Draft Management Proposal, 1990). The emergent macrophytes, such as the common species jointed twig rush (*Baumea articulata*) and bulrush (*Typha orientalis*) are often found in the seasonally inundated and waterlogged areas. For example bulrush grows on the shores of Loch McNess and Herdsman Lake (Figure 14). However, when areas are disturbed the bulrush can succeed existing sedge communities (Bekle, 1984). In the same type of environment there are two common bottom-rooted plants that grow in

deeper water; club rush (*Scirpus validis*) and twig rushes (*Machaerina articulata*) (Seddon, 2004).

The next chapter will discuss traditional indigenous land use management of the environments described above.

Chapter Four:
The Indigenous People's Sustainable Land Management

4.1 Introduction

This chapter examines the Nyoongar indigenous people's established techniques for maintaining food resources obtained by traditional harvesting practices. The Nyoongar pursued a hunter-gatherer lifestyle since their ancestors came to Australia some 50 000 years ago. They developed a deep spiritual attachment to their 'country' deriving a sense of belonging, of identity, and of oneness with the living world (Dingle, 1988).

Exploiting the resources of their environment without planting crops or raising animals 'the Aborigines had evolved a pattern of life that was well-suited to the environment, and which was personally satisfying and rewarding to them' (Lofgren, 1975, p. 61). 'They saw themselves as an integral and vitally involved part of their environment and as one with their territory-a union of the past with the present' (Green, 1984, p.i). Their adaptation and survival was founded on a detailed understanding of nature and natural phenomena (Bourke & Bourke, 1994). They believed that they shared the same life-essence with all the natural species and elements within that environment.

> Wetlands acted as access tracks and trails providing valuable camping sites. According to Seddon (1972), research shows that prior to European settlement there were several small, closely-knit Indigenous peoples' groups around the Swan River [Figure 10]. Each clan had their 'kaleep', or particular preferred camping site, which was of special significance**.** They erected no permanent buildings and lived as nomadic hunter-gatherers, moving with the seasons; therefore there was no competition for ownership of the land (Gilks, 1977).

Living a semi-nomadic lifestyle their main style of living could be called 'open plan' using the natural resources for shelter and storing their belongings. During dry weather the indigenous people lived mostly in the open air (Berndt & Berndt, 1983) (Figure 11).

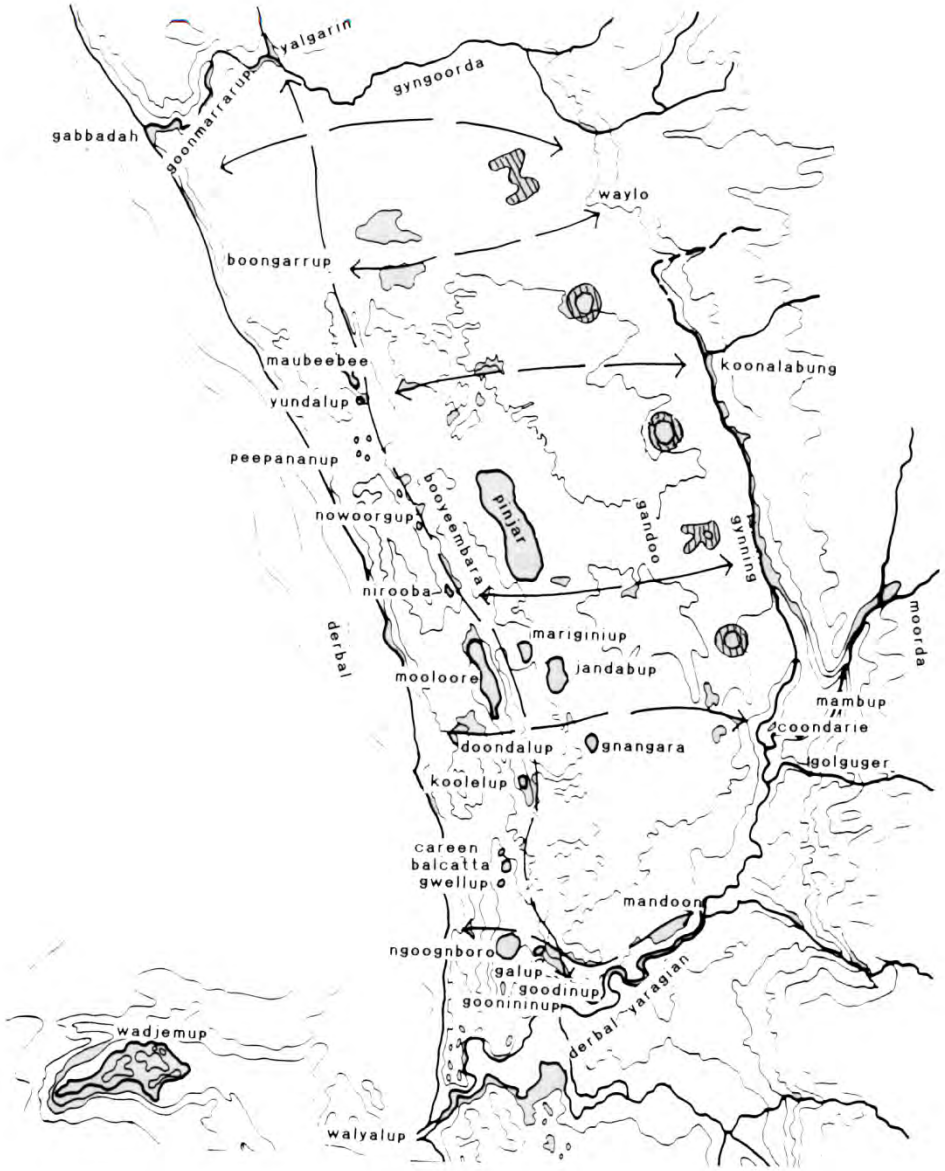

Figure 10: Nyoongar traditional seasonal camping sites along the chain of wetlands from Herdsman Source: Brittain (1990, p. 101).

Note: Herdsman Lake (Ngoogenboro) northwards to Lake Joondalup (Mooloore) and Loch McNess (Maubeebee) also known as (Mambibby) at Yanchep.

Figure 11: Reconstruction of Nyoongar shelter (mia mia). (Yanchep National Park).
Source: Author, July 2012

Note: Because of their semi-nomadic lifestyle the Nyoongar built temporary homes using natural materials that were on hand. The soft bark from the paperbark tree was used as a waterproof cover during wet weather.

Having an intimate knowledge of their surroundings; they lived and moved within their tribal territory (Figure 10). However, they would gather to observe ceremonies and rituals that governed their tribal life, which was based on sufficiency and sharing (Broome, 2001).

During late autumn and early spring they travelled within their own designated territory, setting up camps for as long as the seasonal foods lasted. However, if distant Nyoongar groups encroached on another's territory without invitation, this could provoke anger with the possibility of spearing (Green, 1984).

Their population was controlled by the availability of water, food and other resources (Gilks, 1977). Indigenous people did not plant or cultivate cereal crops, nor did they herd and animals (sheep or cattle, were unknown to them) but relied entirely on a rich variety of native flora and fauna, which they gathered from the land, sea, riverbanks and wetlands. By developing an extremely efficient system of managing the land and its natural resources, the indigenous people maintained the landscape's

ecological balance. They practiced a hunter-gatherer lifestyle that was well suited to their environment and was ecologically sustainable. Head (2000, p.19) states:

> The term hunter-gathers is usually applied as an economic definition based on what people do for a living. Hunter-gatherer understandings of, and relations to land have a dynamic of their own, particularly in questions of change over time.

As hunter-gatherers they moved across their land in accordance with the seasonal changes and their detailed knowledge of the seasonal variation of the natural plant and animal resources that were readily available. Their intimate knowledge of the seasons was reflected in the formation of the resource and weather-based Nyoongar calendar (Figure 12). They divided the year into six seasons (Figure 13). This calendar guided their daily activities and seasonal movements and allows for the effective utilisation of the resources of the area at different times of the year (Bindon & Walley, 1992, pp. 28-35).

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Bunuru: hot easterly and north winds from February to March

Djeran: becoming cooler with winds from southwest from April to March

Makuru: cold and wet with westerly gales from June to July

Djilba: becoming warmer from August to September

Kambarang: rain decreasing from October to November

Birak: hot and dry with easterly winds during the day and south west sea breezes in the late afternoon from December to January

KEY TO WHEEL

1	**KARRAK**	RED-TAILED BLACK COCKATOO
2	**KERL**	BOOMERANG
3	**BUYI**	TORTOISE
4	**MAMANG**	WHALE
5	**KITJ**	SPEAR
6	**KAADAR**	RACEHORSE GOANNA
7	**BALKA**	BLACKBOY

Figure 12: Seasonal Aboriginal peoples' food calendar.
Source: Bindon & Walley (1992).

Season	Approx timing	Usual Weather	Food Supplies/Activities
Birak or Birok	Dec – Jan	Hot and dry, very high evaporation, afternoon breezes	Seeds, lizards, barde, Near lakes: fish, frogs, tortoises, marron, gilgies. swans, ducks, cockatoos. Swamps dry: firing bulrushes. acacia gum
Bunuru or Burnuru	Feb- March	Hot E and N winds, high evaporation	Near lakes. roots, swans, ducks, cockatoos, frogs, tortoises. Collect and treat zamia nuts. banksia, marri and other nectars, sweet or fermented. Bush firing.
Djeran or Wanyaring	April-May	Cooler, SW winds, night dew, showers	*Yanget* (bulrush)-roots. Treated zamia nuts; barde. tortoises. Shelters built, skin cloaks sewn.
Makuru or Maggoro	June-July	Cold and wet, westerly squalls	Near lakes: *yanget* roots, frogs' eggs. Stored zamia nuts. New shoots.
Djilba or Yilba	Aug-Sept	Less rainy, becoming warmer	Near lakes and swamps: *Yanget* roots, frogs, tortoises; burning *yanget* stalks, Hills: yams
Kambarang	Oct-Nov	Rains petering out, night dews, occasional hot days	Hills: young animals, eggs; bulbs. In or near water: tortoises

Figure 13: The six seasons weather-based calendar observed by the Nyoongar people. Source: (Gentilli, 1998, p. 93).

Early settler and Surgeon-Assistant, Isaac Scott Nind wrote in 1831 (cited in Green, 1979, p. 25), observing the seasonal movement of the Nyoongar indigenous people between inland and coastal habitats. He stated:

Those families who have locations on the seacoast quit it during the winter for the interior; and the natives of the interior, in like manner, pay visits to the coast during the fishing season. Excepting at those times, those natives who live together have the exclusive right of fishing and hunting upon the neighboring grounds, which are, in fact, divided into individual properties; the quantity of land owned by each individual being

very considerable. Yet it is not so exclusively his, but others of his family have certain rights over it; so that it may be considered as partly belonging to the tribe. Thus all of them have a right to break down grass trees, kill bandicoots, lizards, and other animals, and dig up roots; but the presence of the owner of the ground is considered necessary when they fire the country for game. As the country does not abound in food, they are seldom stationary, removing, according to the time of the year, to those parts, which produce the articles of provision that may be in season. During the winter and early spring they are very much scattered; but as summer advances they assemble in greater numbers.

The indigenous people exploited their environment successfully, using a wide range of native flora and fauna. The importance of plant staples in indigenous land use and diet is given by explorer George Grey (1841, vol, 2, pp. 259-262). He observed that:

> One mistake very commonly made with regard to the natives of Australia, is to imagine that they have small means of subsistence or are at times greatly pressed for want of food…Generally speaking, the natives live well; in some districts there may be at particular seasons of the year be a deficiency of food…But in his own district a native is very differently situated; he knows exactly what it produces, the proper time at which the several articles are in season…There are, however, subjected to pangs of hunger; these are, in the hottest time of summer, and in the height of the rainy season.

4.2 Traditional indigenous food

When hunting for food the Nyoongar, knew how to interpret all tracks and to mimic the sounds of their prey. This enabled them to advance unnoticed to within spearing or boomerang throwing distance of grazing herbivores, such as kangaroos and emus. Although the men were extremely efficient hunters, they sometimes failed to catch their quarry. Therefore, the tribe relied on women's supply of yams, fruits, vegetables, seeds and small animals (Dingle, 1988). Aided by digging-sticks made from natural materials, and bush skills passed down from generation to generation, women also added their contribution to the food supply, which ensured the survival of the clan (Broome, 1994).

Gathering sufficient food for their immediate use, but always leaving enough behind to ensure their propagation into the future, they managed their resources to good advantage (Lofgren, 1988). 'Their economy was a subsistence one, but it was not a matter of thoughtless, hand-to-mouth existence, or needless wasting of natural resources' (Berndt & Berndt, 1992, p. 109). Without causing the depletion of the natural

valuable resources, they continually changed and perfected their hunter-gatherers lifestyle rather than modifying their environment to suit them.

The number of food plants used was considerable. Numerous different fruits, roots, tubers, and leaves were eaten. Seeds of wild grasses, which are inedible in their natural state, could be processed by grinding them into flour and then baking them (Dingle, 1988). However, the indigenous people have a 'law that no plant bearing seeds is to be dug up after it has flowered; they then call them (for example) the mother of *Bohn* [an edible fruit], the mother of *Mud-ja*' [gum bearing tree]' (Grey, 1841, vol, 2, p. 292).

Hallam (1998, p. 91) noted:

> The most important foods the wetlands had to offer came from 'carbohydrate staple' derived from plant storage organs – fruit and seeds, bulbs and corns, underground root tubers, and starch-filled stems of rhizomes. Reed rhizomes, ground and made into 'damper', provided much of the 'daily bread'.

Generally speaking, it was the job of the women to dig for yams (*Dioscorea*). For this purpose they would carry a long, pointed stick, which was driven firmly into the ground. The roots were eaten raw, or roasted in the fire; other roots are pounded between stones to make a paste, then made into a cake, and baked. They would re-insert the head of the yam into the ground to ensure a future crop (Kohen, 1995).

Lieutenant George Grey (1837, vol, 2, p. 294) noted: 'the natives must be admitted to bestow a sort of cultivation upon this root, as they frequently burn the leaves of the plant in the dry seasons, in order to improve it'. Hallam (2000, p. 12) noted: 'Gathering yams was anything but a random process…It was certainly not a matter of digging out a root here and there, but of returning regularly to extensively used tracks'. 'Early settlers realized the yam ground would make excellent vineyards because the soil was already prepared and lay in ideal locations' (Cunningham, 2005. p. 80).

Backhouse (1834, p. 540) examined the ground where the indigenous people had been digging for roots of a yam. He noted: 'this plant climbs among bushes in a strongish soil, and the Natives have a tradition, respecting its roots having been conferred upon them, in which there are traces of the deluge'.

George Fletcher Moore (1834, p. 220) recorded in his diary:

> Aboriginal people making bread out of the root of the flag, which they called jandyett. [bulrush] It tasted like a cake of oatmeal…[He observed] they peel the root, roast and pound it, and bake it. The root is as thick as your finger and a foot long.
>
> Burning flag leaves prior to the April-May harvest much improved the flavour. The annual yanget season brought feasts and festivities, not only to celebrate the flour but also yanget [bulrush] rushes, which were made into string for tying-up cooking and for sewing skins together (Cunningham, 2005, p.82).

Figure 14: Bulrush (*Typha orientallis*).
Source: Author, August 2012.

Note: The white succulent stem at the base of developing leaves was an important source of food for the Nyoongar. The root is peeled, baked and made into bread. *Typha* has a most effective seed dispersal making it an active coloniser of wetlands.

One of the most important storable staples was the fruit of the zamia palm (*Macrozamia reidlii*). (Figure 26). Before it could be eaten the toxins had to be removed. This was a lengthy process done by the women of the clan. The nuts were collected in March, and placed in a shallow pool of water and left to soak. Having been immersed for several days the nuts are then placed in a dry sandy hole lined with rushes and covered with sand and the tops of the grass-tree. When the pulp, which encases the nut, becomes quite dry, it is then fit to eat (Grey, 1841).

Blossoms of the Marri (*Eucalyptus calaphylla*) soaked in water made a delicious sweet drink, also the insect larvae found under the bark provided a tasty meal. Seeds from the tree were used for medicinal purposes, to cure diarrhoea. The flooded gum (*Eucalyptus rudis*) provided the Nyoongar with a sugar intake. They ate the waxy sugary scales found on the leaves and insects, which sheltered underneath the leaves (Powell, 1990). The oil from eucalypt leaves was also employed for medicinal purposes.

The most plentiful vertebrates in the wetlands were the frogs. Summer and autumn was the best chance to catch them when swamps are nearly dry. Women of the clan plunged their arms into the thick sticky mud, and dragged the frogs out. George Grey's (1841, vol, 2, p. 288) recipe for preparing and cooking this delicacy as follows:

> Frogs are cooked on a slow fire of wood ashes, they are then held in one hand by the hind legs, and a dexterous pinch with the finger and thumb of the other, at once removes the lower portion of the intestines, the remainder of the animal is then taken at a mouthful and fairly eaten from the head to the toes.

Birds also formed a substantial ingredient in the Nyoongar diet. George Grey (1841, vol, 2, pp. 281-282) describes the method of killing them:

> A native perceives a large flight of cockatoos…The native…draws his *hley* [boomerang] from his belt, and with a noiseless elastic step, approaches the lagoon, creeping from tree to tree, from bush to bush…then throwing the boomerang across the water surface and up into the trees, killing some and wounding others.

Bardi grubs (*Bardistus cibarius*), 'also known as witjuti grubs' are rich in protein and fat, were principally found in grass-trees (*Xanthorrea*), wattle trees, and in dead timber; those found in the grass tree have an aromatic nutty flavour, and taste like a nut. Grubs were eaten raw or roasted and regarded as a gourmet delicacy. After George Grey (1841, vol, 2, pp. 221-262) was shown how to toast the grubs he was addicted: 'The *Xanthorrea* affords an inexhaustible supply of fragrant grubs, which an epicure would delight in, when once he has so far conquered his prejudices as to taste them'. However, he makes a comparison between the indigenous and European diet. 'If the natives are taunted with eating such a disgusting species of food as these grubs appear to Europeans, they invariably retort by accusing us of eating raw oysters, which they regard with perfect horror' (Grey, 1841, vol, 2, p. 290).

Lawyer, William Nairne Clark wrote in *The Inquirer* 2nd March 1842:

> It has been said in ignorance that the natives are sometimes reduced to much necessity owing to scarcity of food – such is not the case. If they miss the usual supply of kangaroo there is an abundance of native roots and productions of Providence all over the country supporting human life and very nutritive.

By the end of the 1840s the indigenous people were gradually being excluded from swamps and lakes where they harvested the yams. The settlers had taken the land to grow their own root-crops (Hallam cited in Gentilli, 1998), and the transition from a sustainable use of the landscape to a money-based exploitative one had commenced.

4.3 Firestick farming

> Fire, grass and kangaroos, and the human inhabitants, seen all dependent on each other for existence in Australia…Fire is necessary to burn grass, and from those open forests…the native applies the fire to the grass at certain seasons, in order that a young green crop may subsequently spring up, and so attract and enable him to kill or take the kangaroo with nets (Mitchell, 1848, p. 12).

An almost symbolic relationship between fire, kangaroos and plant life existed.

Because of the semi-nomadic nature of their occupancy there was minimal disturbance to the environment. However, they did influence the environment by the use of fire-stick burning, which they used to increase the productivity of their environment (Kohen, 1995). Sylvia Hallam (1975, p. 15) also documented the use of fire and its impact upon the landscape. 'Aboriginal populations did change the vegetational and faunal balance. Fire was a major factor in this pattern of regular exploitation and settlement'. Tindale & Lindsay (1963, p. 55) also noted: 'As this has been done year after year along recognised routes of travel over a very long period, it has altered the original appearance of strips of county in a remarkable way'.

Rhys Jones coined the expression 'firestick farmers' to describe indigenous peoples' relationship with their land. (cited in Pyne, 1999, p. xii):

> Through their skillful manipulation of fire Aborigines fashioned an analogue of farming, a means by which to massage the indigenous environment into serving their particular needs…an alternative genre in which fire is both a means and an end.

For the purpose of lighting fires, people would carry a fire-stick. The spear of the grass tree (*Xanthorrhoea preissii*) (Figure 15) was used to make torches for hunting (Powell, 1990). During winter months it was carried under their cloaks, for extra warmth. The smouldering fire stick could be brought back to life by swinging it through the air (Green, 1979).

Figure 15: Grass Tree (*Xanthorrhoea preissii*).
Source: Author, September 2012.

Note: The spear of the grass tree was used to make torches when hunting and the resin was collected to make glue to melt onto the handle of stone tools. Pulp was removed and was used as a valuable medicinal property to relieve upset stomachs. The spear was carried under the cloaks of the Nyoongar for extra warmth during winter months.

Grey 1841, vol, 1, (pp. 297-298) made good use of the grass tree whilst camping:

> Our bivouack, this night, had a beauty about it, which would have made any one possessed with the least enthusiasm, fall in love with a bush life…the foreground was covered with graceful grass trees, and at the moment we commenced supper, I made the natives set fire to the dried tops of two of these, and by the light of these, and by the light of these splendid chandeliers, which threw a red glare over the whole forest in our vicinity, we eat our evening meal; then, closing round the fire, rolled ourselves up in our blankets, and laid down to sleep.

The Aboriginal endeavour to improve grazing by fire was assessed by Sir Thomas Mitchell (1848, p. 306); he noted:

> The extensive burning by the natives, a work of considerable labour, and performed in dry warm weather, left tracts in the open forest which had become as green as an emerald with the young crops of grass. These plains were thickly imprinted with the feet of kangaroos, and the work is undertaken by the natives to attract these animals to such places. How natural must be the aversion of the natives to the intrusion of another race of men with cattle: people who recognize no right in the aborigines to either the grass, they have thus worked from infancy, nor to the kangaroos they have hunted with their fathers.

Fire also kept the country open and inadvertently prepared the land for early European settlers. Pyne, (1991, p. 148) discusses the comparison between Australia's indigenous people use of fire and other hunting and foraging societies:

> Compared with the fire practices of agriculturalist, Aboriginal fire was more subtle, more allied to natural biota. When farmers burned, they used fire to dispose of native vegetation, to prepare a site to receive exotic cultigens; pastoralists, to encourage forage for alien livestock, or to sow alien grasses. But Australia's Aborigines burned to select from among Indigenous flora, and their fires had to conform to the rhythms and flows of those fuels, droughts and winds (Pyne, 1991, p. 148).

However, fires would sometimes get out of control and deprive the early settlers of feed for their stock. Fire swept through holdings, destroying crops and leaving behind the charred carcasses of sheep, cattle, horses and goats. Therefore many settlers forbade the Nyoongar from lighting fires on their property (Green, 1984).

James Backhouse wrote (1843) on 22nd January 1838:

> In the cool of the evening we returned to Perth…much of the bush on the road had been recently burnt, and one house has been consumed by fire. The natives are now setting fire to the scrub in various places to facilitate their hunting, and to afford young herbage to the kangaroos.

Nevertheless, the burning of organic matter on the forest floor was appreciated by many of the early settlers. The *Inquirer* April 14th 1841 reported:

> The absence of fertility is naturally accounted for in a very dry climate by the summer fires passing over a great portion of the surface of the country, and preventing any accumulation of decayed vegetation.

The early settlers saw fire as the enemy, a force of destruction rather than a natural part of ecosystems (Head, 2000). In comparison, 'Indigenous people speak of using fire for 'clearing', 'caring for' and 'looking after country' (Head, 2000, p. 129). Pyne cited in Kohen, (1995, p. 108) suggests that:

> What distinguished the Aboriginal regime was the amount of burning that occurred in the midseason, the regularity of the annual burning cycle, the insistence that some areas never be fired and that others be fired as often as possible.

Lieutenant Henry Bunbury (cited in Pyne, 1991, p. 87) explained that:

> We could never do it [burn] with the same judgment and good effect as the natives, who keep the fire within due bounds, only burning those parts they wish when the scrub becomes too thick or when they have another object to gain by it.

However, since early European settlement the cessation of the firestick regime had led to some perennial shrubs and grasses (maintained through regular burning) being lost in many areas.

4.4 Indigenous people's mythology relating to the land

The cultural significance of the land to the indigenous people was, and is, very strong in mythology, involving the elements of serpent, water, earth, cave and fire. Dreamtime stories explain how the landscape and physical environment were created. Life was regulated by laws and customs passed down through the generations and interpreted by senior men and women. The stories of the Dreaming were passed around the campfire, and presented in the dances at the corroboree. All Nyoongar trace their origin to the Dreamtime; they regard themselves as inseparable from the external process of nature. Green (1984, p.21) elaborated on this notion:

> Aboriginal mythology is rich in stories that reveal the interaction and common origins in the Dreaming. There were legends, which told that certain stars and planets were previously people and, on summer nights when the southern skies were bright and clear, the star lore was passed down the generations to the children. The Dreaming linked the Nyungar to the Aboriginal Creation and gave them not only an affinity with the land but a personal relationship to it. It was an existence in which Aboriginal man had both place and purpose a place determined by kinship and a purpose that everyone recognised and acknowledged.

The following description by Bomford and Caughley (1996, p. 16) also describes the significance of land for indigenous people:

> Aboriginal lore was established during the Dreaming when ancestral beings walked the earth, creating the landscape and all living species. The Dreaming brought order and meaning to an already existing world and all entities became subject to common law.

One figure of particular significance in indigenous peoples' mythology is the 'Waugyl' (Figure 16) because of its association with the landscape, water, lakes, swamps, the sea and caves. According to indigenous people, this mythological creature created the valley of the Swan River. It was shaped like a snake or crocodile and left traces of its journey from the hills to the ocean in the forms of curves and windings of the river (Bourke, 1987).

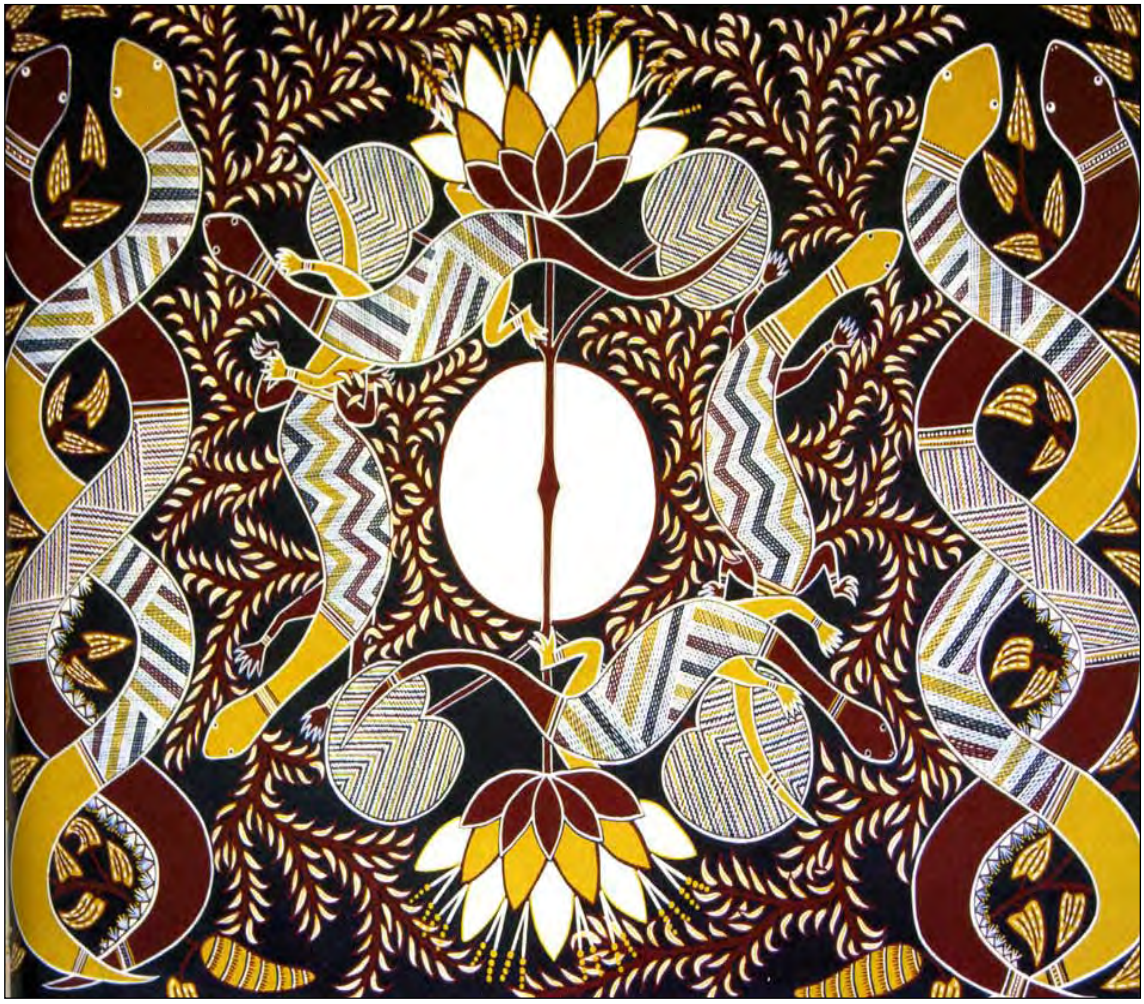

Figure 16: Waugyl. Modern representation of a traditional story.
Source: (Storm, 2007, p. 228).

Note: The waugyl is an important ancestor of the Nyoongar indigenous people of Western Australia. It is an imaginary aquatic monster endowed with supernatural powers causing untold harm to anyone who disturbs him.

4.5 Nyoongar relating to early European settlers, assuming them to be ancestors

The Nyoongar initially welcomed the early European settlers believing they were the embodied spirits of their departed ancestors. They referred to the settlers as '*Djanga*' meaning the 'dead', of the 'spirit'. They thought the dark pigment had been washed away from the ancestor's skins during the long journey through the sea after death. It was incomprehensible to them that people would leave their land of origin (Bourke, 1987). 'At first the settlers found it rather disconcerting to be hailed as father, brother or other, but after a while it was accepted with a great deal of humour and paternalism' (Green, 1984, p. 5). George Grey (1841, vol, 2, pp. 299-303) wrote is his diaries:

This belief, that white people are the souls of departed blacks, is by no means an uncommon superstition amongst them; they themselves never having an idea of quitting

their own land, cannot imagine others doing it, and thus, when they see white people suddenly appear in their country, and setting themselves down in particular spots, they image that they must have formed an attachment for this land in some other state of existence; and hence conclude the settlers were at one point black men, and their own relatives.

He also wrote on a more personal nature of how an old indigenous woman greeted him whilst on his expeditions:

> At last the old lady emboldened by my admission, deliberately kissed me on each cheek…she then cried a little more, and at length releasing me, assured me that I was the ghost of her son, who had some time before been killed by a spear wound in his breast. (Grey, 1841, vol, 2, p. 302).

However, it did not take long before they changed their perception of the settlers as soon as it became obvious they were not their deceased relatives. As the early settlers occupation of the land was steadily rising 'the white man looked less like the '*Dyanga*', and more like a '*Wadjalla'* (white fella)' (Brittain, 1990, p. 11). The Nyoongar subsequently encountered a fundamental change to their society.

4.6 Summary

This chapter demonstrates by research through contemporary sources how the original inhabitants of the Swan Coastal Plain, known locally as the Nyoongar, pursued a lifestyle that was well suited to their environment and was ecologically sustainable. Taking from the land what nature provided they maintained the landscape's ecological balance. How the Nyoongar perceived their environment influenced the way they interacted with the environment. However, they did influence the environment to some extent by the use of fire-stick burning which they used to augment the productivity of their milieu. This inadvertently prepared the land for the early European settlers by producing open land suitable for grazing by stock. The burning of the land was 'probably the most pervasive effect on the natural environment (Blainey, 1975, p. 82).

> Indigenous people may not have a 'science of management'. Their form of management is not through a series of written, codified rules and regulations, but through a series of unwritten religious rules and taboos passed on as part of the oral tradition from generation to generation (Aplin, 2002, p. 234).

However, the Australian landscape was profoundly altered through the replacement of indigenous land management with that of the early European settlers. The settlers transformed the land into new cultural landscapes, based largely upon

European models, with the introduction of alien plants and livestock. As time went by it became apparent they intended to take up permanent residence. However, the Nyoongar were living at locations that the settlers were to find most adaptable to their needs.

At the beginning of European settlement the relationship between the Nyoongar and the early settlers was amicable. However, misunderstandings over concepts of ownership of land and language difficulties, led to the breakdown of relationship between the two groups, which ultimately led to conflict. The Nyoongar could not understand the western concept of ownership, or that of theft. They considered it their right to gather flora and fauna found within their 'traditional estates' (Clarke, 2007, p. 136).

Isolation and an unfamiliar environment made it essential that a new society and a new economy should be developed in this unfamiliar habitat causing them to adopt different attitudes and methods. However, the profound change in the environment meant inevitable and irreversible lifestyle changes for the Nyoongar. They were torn between two cultures. They could not conform to the early settlers lifestyle, and found it difficult to sustain their own.

> European contact with the Nyungar was slow and extended over two centuries before a permanent English settlement was established. Nevertheless, the European impact would inevitably and permantly shatter the Nyungar society and it would be accomplished within a span of one human lifetime (Green, 1984, p. 22).

The following chapter describes in greater detail the transitional period from indigenous to early European land management practices.

Chapter Five:
Early European Settlement

The previous chapter discussed the onset of European cultural perceptions upon an already established indigenous cultural landscape. It described their hunting and gathering lifestyle, which was based on sufficiency and sharing. However, the interaction between the two cultures transformed the indigenous landscape and over time a new landscape emerged. The incoming culture was to alter the environment far more dramatically, both initially and in the long term.

> Change is a characteristic of human societies and when the members of a society agree to the change and have time to make the necessary physical and psychological adjustments the change may advantage them. However, when a society has no control over the nature and intensity of the change its customs, law and its very existence are in jeopardy. And this happened in Australia after the arrival of European settlers. (Green, 1984, p. 21).

5.1 Early exploration of the Swan Coastal Plain

Although there were indigenous communities throughout Australia at the time of early European settlement, the early settlers justified their right to occupation by the legal doctrine of *terra nullius* (land of no-one) or a belief that prior to European settlement Australia was an 'empty land'. Europeans saw no moral or legal barriers to stop them taking over the land (Markus, 1994).

Captain James Stirling in 1827, made a thorough examination of the Swan River and the surrounding landscape. Lieutenant Gilbert, a member of the group stated: 'our expectations of the advantages of a settlement on the Swan River are now fully confirmed. The climate was acceptable, the soils were good, for cultivation that future settlers would enjoy'. However, this appraisal was misleading, as only near the Swan River did the soils lend themselves to permanent cultivation (Cooper & McDonald, 1999). The fundamental difficulty the settlers faced was to obtain land, which was of some practical use. Sterling's enthusiastic account of fertility was flawed, as much of the land was unsuitable for agriculture.

> Established in June 1829, Swan River was the first British colony in Australia founded exclusively for private settlement, and the only one to be founded on the basis of a land system, where grants were apportioned according to the value of assets and labour introduced by settlers (Statham, 1981, p. 181).

By 29th September of the same year, the first grants of rural lands along the Swan River were given to the early settlers and a new era of land clearance, exploitation of resources and the gradual fragmentation of natural ecosystems had commenced.

5.2 First settlers' new beginnings: the transformation of a landscape

The early settlers were generally men of strength and determination. Ogle (1839, p. 43) advised future migrants:

> Emigrants, who leave their mother country, must remember that they go voluntary to win their independence by the 'sweat of their brow'; and that reflection, caution, unremitting perseverance, and great moral courage, are indispensable requisites. If on self-examination those qualifications are wanting, the person may conclude that such a life is not suited to him.

'It is a step not to be taken without great consideration, and when decided on, with systematic caution' (Ogle, 1839, p. 280).

In order to survive their first years in a new land, the settlers had to start from the ground up, with 'unfamiliar materials, unpredictable seasons, and undeveloped skills'. 'The pioneer used ingenuity to compensate for his lack of formal training and the scarcity of skilled labour' (Ingpen, 1972, p. 18). As soon as they chose the location for permanent homes, they looked for suitable materials with which to build (Ingpen, 1972). 'The barriers of class were destroyed by the sheer need for people to rely upon each other' (Ingpen, 1972, p. 10). Each family had to adapt to their new environment, or lose everything. 'In such ways the pioneer used ingenuity to compensate for his lack of formal training and the scarcity of skilled labour' (Ingpen, 1972, p. 18).

The most available material was timber. It was split into slabs to build simple log cabins. 'When migrant workers saved sufficient money, they bought small blocks…and sent for their families' (Russo, 1998, p. 133). It was a simple beginning, and as the family grew, extra rooms were added until the settler could afford to build a home of stone or brick.

European settlers believed they could change the Australian landscape into an ordered European- style landscape. They produced food that they were familiar with, and pursued the lifestyle they saw as most favourable. The early colonists regarded native food plants to be poor in taste and difficult to process. However, they found kangaroo meat an acceptable source of nourishment (Ingpen, 1972). Landor (1847, p. 106) illustrates the discontent of many early settlers: 'they find that they are no better

off in the new country. The gum-trees do not produce bread, nor the banksias shoulders of mutton'. They were miserably disappointed.

With the onset of summer, conditions became even more miserable for the settlers. Intense heat brought an increase of flies and mosquitoes. There was also a shortage of drinking water and over-crowed living conditions meant hygiene was almost non-existent and in the fly-swarming heat many settlers died of dysentery (Russo & Schmitt, 1987).

It soon became clear reports of an 'earthly delight' were largely a fantasy. There were a few scattered areas of good land with few areas of natural grassland, the coastal strip being mainly sandy, limestone country. Rich river flats were lush in summer; however, these were flooded and waterlogged in winter. Where clearing of the land was easy, soil was largely poor, while in richer, timbered country clearing was extremely difficult (Calder, 1977).

The early settlers set about transforming the environment by destroying the signs of former occupancy, this was especially ironical, as the indigenous people had made their task of transformation easier.

> The Aborigines' tracks laid the basis of the road networks, their camp sites became homesteads and towns, their yam grounds became arable fields and their hunting grounds, so carefully tended by fire, became ideal pastures for sheep (Cameron, 1981, p. 199).

Settlers brought plants, shrubs and seeds from the homelands to develop gardens that reminded them of home. However, these alien plants out-competed native species and since early European settlement about one quarter of plant species on the Swan Coastal Plain have been introduced from elsewhere.

The introduction of exotic species has been one of the greatest adverse influences on the Australian environment. Aplin (2002, p. 256) noted:

> Because the introduced species are not part of the natural ecosystems, they may not experience the checks and balances that are part of the complexity of ecosystems…They may lack predators, competitors, diseases or pests that control their numbers…On the other hand, they can become predators, competitors, diseases or pests to which native species are not adapted.

'By spreading alien plants and animals, these settlers started a process of rapid landscape transformation that continues today' (Clarke, 2007, p. 133). Pyne (1991, p.215) noted:

> The exotic fauna demanded exotic flora, they would thrive best in association with those plants with which they had coevolved. With the introduction of livestock by the early settlers an ecological chain reaction led to an explosion of alien flora.

5.3 Conflict between the Nyoongar and the early European settlers

Cattle, sheep and horses introduced by the settlers destroyed the ground cover on which the natural food of the indigenous people relied. This also limited the amount of grazing land needed by the kangaroo population and other native species.

The Nynoogar could not understand the western concept of ownership, or that of theft. The best hunting grounds for the settlers frequently coincided with their sacred sites, which were often close to permanent water supplies. Therefore the Nyoongar were barred access to these sites. Misunderstandings were also exacerbated by language difficulties, and competing demands for the land that sustained their livelihoods led to the breakdown of relations between the two groups.

When the early settlers took fertile land the Nyoongar were forced to frequent the margins of their terrain. 'To return to the tribal zones beyond the ranges could take family groups across farm lands…where they might be forced to alleviate hunger with potatoes or sheep taken from a farmer's run despite the consequences' (Green, 1984, p. 183).

> The self-confident Englishman, despite his struggle to succeed…had little need to do any rethinking. He was realistic about the unpromising homeland he had left, and desperate about the new one he had come to. His line of thinking was in the ascendant and he had everything to gain. He was land-hungry. The Njungar was not prepared for such thinking or its conclusion. He stood in stunned awe before these enigmatic intruders… (Brittain cited in Gentilli 1998. p. 109).

The settlers did not understand the importance of the indigenous people's hunter-gatherers movement across the land or the way it related to the availability of food supply according to the seasons. They were ignorant of their cultural and spiritual traditions, which led them to misunderstand the movement of the Nyoongar as aimless and wandering.

> When a society has no control over the nature and intensity of the change its customs, law, its very existence are in jeopardy. And this happened in Australia after the arrival of European settlers…the European impact would inevitably and permanently shatter the Nyungar society and it was to be accomplished within the span of one human lifetime (Green, 1984, pp. 21-22).

Early settlers resented the indigenous people's occupancy of the land, especially their technique of firestick burning (addressed in Chapter 4). The burnings formed a source of conflict between the two communities. The *Inquirer* March 31st 1841) advised the settlers accordingly:

> The utmost precautions are requisite to guard buildings and stacks from fire during the dry season, when everything is in a highly combustible state; on which account, thatched roofs should not be used for permanent buildings; and the practice of surrounding them as well as stacks by a ploughed band 12-15 feet wide has been found a useful precaution.

The early settlers set about transforming the land into a more familiar scene. They dammed major rivers, burnt and cut jarrah, tuart and banksias trees, and drained and filled swamps. However, they had no idea of the pioneering difficulties they would have to face. They underestimated the economic and personal costs their attempts to reproduce an English society in an uncultured wilderness. Their efforts were courageous but often impracticable.

5.4 Summary

Green (1984, p. 55) describes the attitudes of early settlers towards the Australian landscape:

> European man in common with Aboriginal man had a dependence upon the land for food, shelter, and clothing, but unlike the Aborigine he regarded land as an indicator of wealth and status. Therefore he sought to own, and exploit it to achieve his personal goals.

However, the Nyoongar knew who they were and what was expected of each other. 'By contrast the settlers…belonged to different levels of society, were disoriented and uncertain in the new land and experienced what we now refer to as culture shock' (Green, 1984, p. 55). 'The barriers of class were destroyed by the sheer need for people to rely upon each other' (Ingpen, 1972, p. 10).

The introduction of new ideas into an established cultural system was a disruptive experience for both the Nyoongar and the environment. Head, (2000, p. 18) states: 'People always come from somewhere, bringing with them plants, animals and cultural concepts'. Early European settlers damaged the balance between humans and nature, which contributed to the progressive fragmentation of the wetlands and its life-support systems. The function of the land changed significantly, and with it the nature of the landscape. This concept has been demonstrated throughout this chapter.

The Chapter that follows contrasts the impact of the indigenous people with that of the early European settlers upon the landscape of the Herdsman Lake basin.

Chapter Six:
Herdsman Lake

6.1 Introduction

Herdsman Lake is situated approximately seven kilometres northwest of central business district of Perth at 31° 55'S, 115° 48'E (Figure 1). It is the largest lake within this vicinity and is fed by both groundwater and surface water flows. It is part of a chain of interconnecting lakes that extend parallel to the coast, in the Spearwood Dune System (discussed in Chapter 3).

The original Herdsman Lake was essentially a marsh totalling approximately 420 ha, which flooded to a depth of two metres in the winter month; in the summer, due to evaporation the Lake dried out (Bekle, 1981). Early European settlers described the Lake as an area of open water with fringing rushes and fresh water paperbarks (*Melaleuca rhaphiohylla*) with swamp banksias (*Banksia littoralis*) with gums (*Eucalyptus rudis*) and an understorey of shrubs (Bekle, 1981).

Prior to the 1920s Herdsman Lake was primarily an expression of the groundwater with a considerable inflow of water along its northern and northeastern boundaries from the Gnangara mound (Bekle, 1981). The Lake is subject to considerable seasonal changes in water depths. Depths fluctuate from dry during summer to approximately 50 cm in winter (Gould League of Western Australia, 1984).

Before European colonization the indigenous people (the original inhabitants) called the Lake *'Ngurgnboro'*. However, according to surveyor A.L.Lewis' survey map of 1895, it was named the Lake *'Ncoorcenboro'* (Figure 5). The Early settlers referred to the Lake, as The Great Lake but by 1836 it had been renamed by Surveyor General J.S.Roe, 'Herdsman's Lake'. It was later to become known as 'Herdsman Lake' and this name remains.

Figure 17: Herdsman Lake.
Source: Author, October 2012.

Note: Herdsman Lake is the largest wetland within the inner metropolitan area of Perth. Its surrounds support a vast complexity of wildlife and are of significance as a breeding and summer refuge for many waterfowl, bush birds and birds of prey. The dominant and most prolific species is the bulrush (*Thypha orientallis*). On the distant shore of the Lake the encroachment of urbanisation can be seen.

6.2 Indigenous occupation

Herdsman Lake was in the 'country' called 'Mooro' home of Yellagonga's people (known as Nyoongar). They would hold gatherings and ceremonies and collect plant resources, The Nyoongar utilised the natural resources of the Lake and surrounding areas during their seasonal hunting pattern firing the fringes of the reed beds. They were attracted to the area because of the rich countryside and permanent fresh water. The Lake supplied an important source of protein in the form of frogs, tortoises, and waterfowl. For a staple supply of carbohydrate their diet also included stems and roots of various wetland plants including *Typha orientalis* (discussed in Chapter 3).

Although little is known of Nyoongar use and association with the area pioneer anthropologist Daisy Bates makes reference to an indigenous burial site. However, its exact location is unknown, it could be 'anywhere within a few kilometres of the Lake edge' (cited in O'Connor; Quartermaine & Bodney 1989).

→N

Figure 18: Survey by A.C. Gregory of locations around Herdsman's Lake 1842.
Source: State Records Office of Western Australia

6.3 Early European settlers

There have been many schemes suggested for the use of the land surrounding Herdsman Lake. Plans for its use have included: grazing and market gardening, rubbish disposal, the site for Perth's main airport, drainage management, dissection by main roads, and development as a deep lake for boating (Blyth & Halse, 1986). It was also seen as a possible water supply for Perth. However, due to difficulties of pumping water uphill, the scheme was abandoned.

The Lake was nevertheless a source of water supply for early settlers, both for irrigation of market gardens, and water for dairy cows and other stock. Until rainwater tanks and wells were established water that ran through the drains was boiled for drinking purposes (Thomas, 1989).

The earliest Crown grant in 1837 of 367 acres was made to Mr. Thomas Helms for developing it into a mixed farm: he named his property 'Helmsville'. Land was fenced, wells dug, and farm buildings erected. Labourers transformed the swamp into a productive farm. 'There was permanent pasture over an extensive area of low-lying land, a stockyard and shed for the dairy herd, and over 40 hectares of fertile alluvial soil awaiting the plough' (Cooper & McDonald, 1999, p. 46). After his death the land was sold to Bishop Gibney, the Roman Catholic Bishop of Perth (Easton, 1971).

Also in the 1830s early settler and master builder, Henry Trigg was granted 500 acres of land that ran parallel to the coast. Recognising the value of the land he established a quarrying and lime-burning business. In 1839, he purchased adjacent land to the south of his land from Surveyor General Septumus Roe. At the peak of the limestone kiln operations more than 50 men were employed at the site. The foundations for the Perth Town Hall were constructed using the lime and stone from the quarry. In 1847 the land was sold to a Walter Padbury who consolidated it with his land making it a 1 234-acre landholding that became known as the 'Limekilns Estate' (Quarry: History of the Quarry, 2012).

Meanwhile changes were occurring on land close to the Lake. An advertisement was published in the *Inquirer* 23rd February 1848:

> About 20 acres of land, situated near Herdsman's Lake, about 12 acres of which are cleared and under cultivation and fenced, and a large portion trenched and planted with vines and choice fruit-trees. There are also two good slab houses, stockyard. Apply to R.Smith, on the premises, or at the office of this journal.

In the 1850s arrival of convicts in Perth brought an increase in the demand for meat. Landowners around the Lake grazed stock on the their land for the new market. After the slaughtering of cattle was banned in the Perth townsite in 1853, slaughterer Walter Padbury established an extensive slaughtering works on 1 243 acres of low-lying, fertile land surrounding the Lake. He also owned a butcher's shop and tannery in Perth, thus creating an outlet for surplus stock. In 1855 he obtained permission to supply fresh meat daily from his abattoir (Cooper & McDonald, 1999).

By 1854 the Roman Catholic Church owned a large area of land in the vicinity of the Lake. The land was granted to a group of Benedictine monks. (This was the same land acquired by Bishop Gibney). Living in bush huts beside the Lake, the monks cleared the land for vineyards and orchards. Swamp lands with their peaty soil, were initially found to be ideal ground to produce vegetables. However, there were no mechanical tools; therefore to establish a market garden it required hard labour. The swamp had to be cleared of vegetation; reeds, rushes and other undergrowth before garden plots could be formed (Thomas, 1989).

On the southern fringes of the Lake, boys from the local orphanage cultivated a thriving market garden. In 1875 the Editor of *The Record* was enthusiastic about its productivity. He wrote:

> We also have much pleasure in stating that a large tract of very fair land has been cleared contiguous to what is known as the Big Lake, and that potatoes and vegetables in quantities have already been produced this season.

The Chinese immigrants also recognised the possibilities of using the wetlands for agricultural purposes. However, to supplement their diet the Chinese considered the long necked tortoise (*Chelodina oblonga*) a delicacy for soups and stews. These aquatic animals were abundant along the shores of the Lake, and for pocket money school children caught them and sold them to the Chinese. Another creature considered a delicacy was the long tailed or racehorse goanna (*Varanus flavirufus*). Because the Chinese required all animals to be alive the goanna had to be tied by the leg to a stick before being sold (Thomas, 1989).

The later part of the 19th Century Surveyor General Roe 'had visions of using nearby Lake Monger as a reservoir, into which water would be diverted from Herdsman Lake and adjoining wetlands' (Cooper & McDonald 1999, p. 44).

6.4 Drainage, cultivation and reversion

As early as 1848, a government committee stated that there was no objection to draining the Lake to recover its 1 057 acres of arable land. Because of the remoteness from the townsite, however, it was felt there was no urgency.

An article in *The West Australian* (10th March 1902) 'Herdsman Lake has been proclaimed a reserve for native game. All shooting and taking or destroying eggs within the limits of the Lake is strongly prohibited'.

After World War I the Returned Sailors, Soldiers and Nurses Association of Western Australia urged the government to buy and drain Herdsman Lake to reclaim the fringing land. Their aim was to place returning soldiers on it as market gardeners and settlers. The government repurchased 82 hectares from the Roman Catholic Church and in 1920 an Act to authorise certain works for the drainage of Herdsman's Lake was passed (Figure 19).

HERDSMAN'S LAKE DRAINAGE.

11° Geo. V., No. XXIII.

No. 23 of 1920.

AN ACT to authorise certain works for the Drainage of Herdsman's Lake, and to apply to such works the provisions of the Metropolitan Water Supply, Sewerage, and Drainage Act, 1909, relating to Stormwater Drains.

[*Assented to 31st December*, 1920.]

BE it enacted by the King's Most Excellent Majesty, by and with the advice and consent of the Legislative Council and Legislative Assembly of Western Australia, in this present Parliament assembled, and by the authority of the same, as follows:—

Short title.

1. This Act may be cited as the *Herdsman's Lake Drainage Act*, 1920, and shall be read as one with the Metropolitan Water Supply, Sewerage, and Drainage Act, 1909, hereinafter referred to as the principal Act.

Power to construct works.

2. It shall be lawful for the Minister for Water Supply, Sewerage, and Drainage, under and subject to the provisions of the principal Act, to construct and maintain the works for the drainage of Herdsman's Lake as described in the Schedule to this Act.

Application of the provisions of Act No. 43 of 1909.

3. All the provisions of the Metropolitan Water Supply, Sewerage, and Drainage Act, 1909, relating to stormwater drains, including Part VIII. thereof, shall apply to the works authorised by this Act; and that portion of the Metropolitan Water, Sewerage, and Drainage Area drained by the works authorised by this Act shall be constituted a stormwater district, and the drains shall be deemed stormwater drains.

The Schedule.

Description of Authorised Works.

The construction of drains, regulating gates, and tunnel with necessary shafts and bores and fencing, from the outlet of an old drain in Location A O, on the West side of Herdsman's Lake (Njookenboro), through Locations A N and 1251; thence through the City of Perth Endowment Lands to the Indian Ocean.

Figure 19: Herdsman's Lake Drainage Act 1920.

Work commenced in February 1921, but the actual development of the tunnel began four months later. The start of a three-kilometre tunnel to an outlet in the ocean near Floreat Beach had begun. 'From its dark gloomy exit, guarded by two projecting stone and concrete walls and an iron grill like the mouth of an old English dungeon, flow forth the waters of Herdsman's Lake' *Western Mail*, (7th August, 1924, p. 15).

Published in *The West Australian* (2nd April 1921, p. 10): 'The scheme to drain Herdsman's Lake in order to make available to Returned Soldiers' for intense culture its thousand acres of swamp land has been commenced by the Public Works Department'. The area was drained for agriculture, and market gardens were established across much of the low-lying land. It took four years to complete the scheme; involving tunnelling to a depth of 45 metres (Figure 20). The digging of the tunnel employed approximately 50 men. After completion, for the first three days six million gallons of water every twenty-four hours poured into the sea (Cooper & McDonald, 1999).

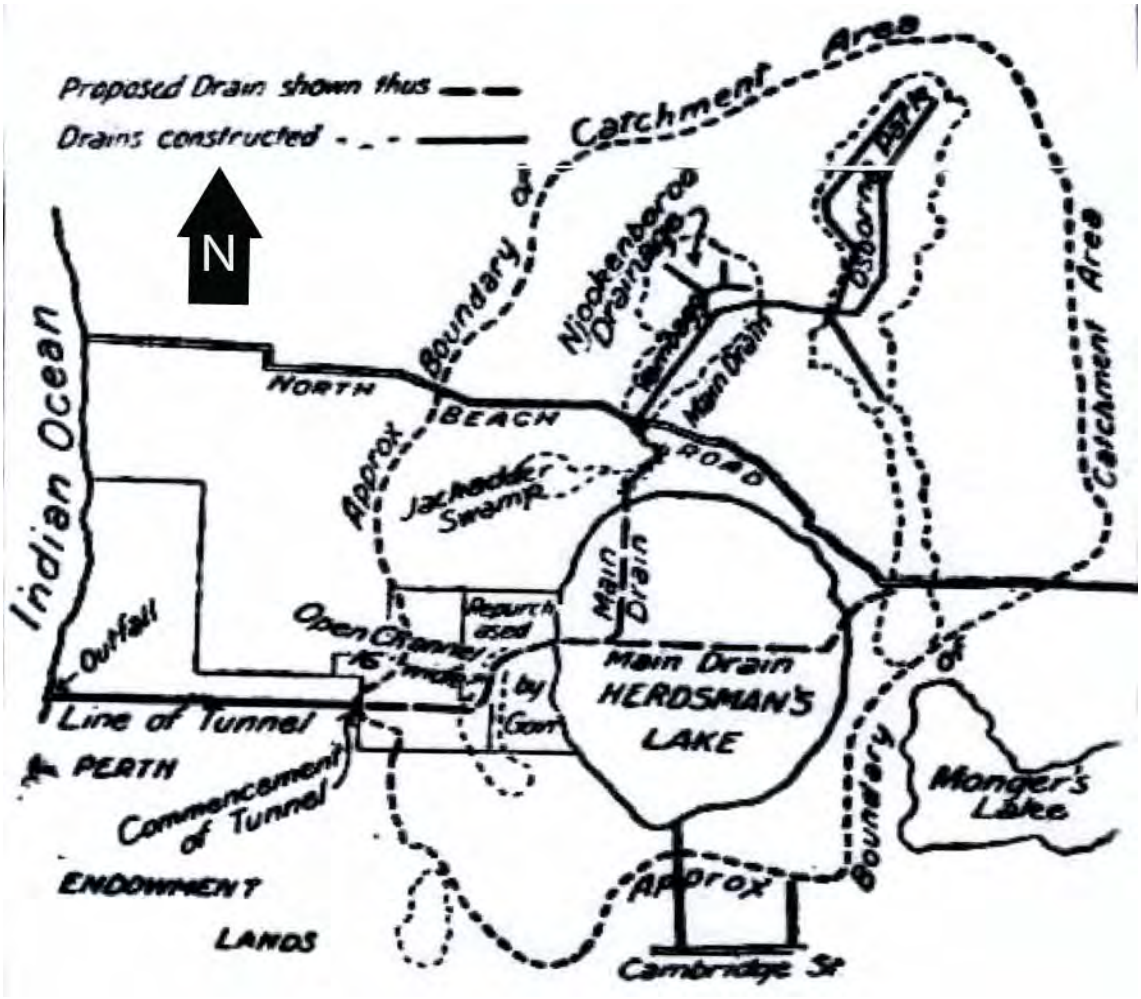

Figure 20: Herdsman Lake drainage tunnel.
Source: *The West Australian* 20th December 1922

Note: Each day about 32,000,000 gallons of water surged along the tunnel to the sea at Floreat Beach.

An article written by Leslie Rees to the Editor of the *Western Mail* (7 August 1924, p. 15) describes the Lake as:

> Wide stretch of most beautiful green turf which runs like a carpet for some distance around the lake…reminiscent of some English countryside. Towards the south side of the Lake is at least one settler who reaps a rich crop of luscious green maize or grows vegetables in the fertile soil of the marshland.

Following a winding track Rees continues his journey to a completely different scene:

> At this point one begins to see the fruits of the lake drainage operations. Here are many acres of drained land, covered with thick slimy mud, sustaining a yellow and unhealthy reed growth. Volumes of water have been drawn off this part: but the visitor must beware of approaching too near if he does not wish to sink to his knees in treacherous swamp mud.

Description of the soil in Herdsman Lake was reported in *Western Mail* (5th January 1928 p. 47) 'The soil of the Lake is of excellent quality for market gardening, it contains, limestone, bird guano and rotted vegetation, and in parts, 17 feet deep before a clay bottom is reached'.

There were inquires concerning land available in the Herdsman Lake area. The following advertisement appeared in the *The West Australian* (March 7th 1931, p.6):

> Applications for 19 blocks, situated at Herdsman Lake, where cottages are erected…these blocks are situated about four miles from Perth Town Hall, and are suitable for market gardening. The terms of payment are fortnightly, and extend over 30 years.

In the 1930s Professor J.A.Prescott, chief of the soil research division of the *Council for Scientific and Industrial Research* examined the soil taken from the Lake, and reported as follows in *The West Australian* (27th November 1935 p. 23):

> It is the most remarkable soil I have ever seen, and I think it owes its special character to fact that the organic matter is not humified. It is difficult to say how long such material would take to become true soil and there will certainly be a risk involved in cutting up the lake for market garden purposes as was originally intended.

Dairymen from surrounding districts requested that part of the Lake not required for immediate settlement be made available for depasturing of stock. The then *Minister of Lands* (Mr. C.J.Latham) informed them that a plan had been proposed to cut up the area in question and to extend and deepen the drainage. He recommended 10 areas averaging about 40 acres over a period of ten years. For six months in the year there

would be good pasture, and for the remaining six if the land was properly cultivated after drainage, feed could be grown (*Western Mail* 22nd January 1931).

However, during winter months the land was flooded, and in summer it was not capable of being irrigated (Easton, 1971). 'To assist the drainage it was suggested to the settlers…they should lay out cultivation areas in sections with raised beds, with drains between…this system would assist drainage and tend to sweeten the soil and make it more suitable for cultivation…some soil which had been elevated…was proved to be free from acid (*The West Australian* 27th August, 1931, p. 15).

In the 1930s, several settlers were located on land around the Lake's perimeter. Provision of land was made at one end of the Lake where settlers and their families could be housed. It was necessary for the settlers to acquire high land in case of flooding. Some taking up the blocks purely because they were offered a house at a low rental. However, many encountered difficulties clearing their land, obtaining satisfactory water supply, and suitable drainage to remove certain chemical properties, which were affecting production.

Some settlers tried trenching their land to grow rhubarb, and were pleased at the vigorous growth of their plants. However, as soon as the roots reached the water table below the surface of the soil, the plants died due to the deleterious properties of the soil. Other settlers experimented with fodder crops, white clover, Italian rye, and grass. These also failed to produce (*The West Australian* 27th November, 1935).

An article appeared in *The West Australian* (27th November 1935) stating: 'Herdsman Lake represented a Government capital outlay of nearly £150 000 and all there was to show for it was a swampy waste land with 40 cottages lining its shores'. Nearly all of the swampland at the rear of the cottages remained untouched and land that had been cleared of rushes was allowed to revent. Failure to heed initial warnings that the soil was doubtful and concerning the actual likely cost of drainage was not followed. It had become a very costly settlement scheme.

There were numerous complaints from settlers about stray cattle damaging fences, vegetable crops and drains. Cattle were frequently caught in the drains and on occasions dead animals had to be removed. Where water flowed through an open drain and past houses, the Health Inspector found that:

> Nine settlers had horses, eleven had cows, eleven had dogs, and nine had poultry…a condition of lease was that stock should not be allowed

> to water at the drain, which had been constructed for irrigation in the summer and drainage in the winter (*The West Australian* 1936, p. 16).

Although the Lake had been drained market gardeners were warned that the peaty soil in the summer could become ignited. In 1937 dairymen leasing grazing land on the reclaimed land suffered financial loss as a result of a fire that had been burning on the peat swamp. As there is no water supply in the vicinity the fire continued to burn until the rain extinguished it (*The West Australian* 9th April 1937).

Settlers for the most part, were men in regular employment, few were practical market gardeners although one or two retired farmers, who in their spare time could produce their own milk, butter, eggs and vegetables. The settlers soon realised that to develop five acres of swampland was extremely difficult and a full-time job for one man. Their houses in winter became waterlogged due to drainage difficulties and during summer months the drainage scheme was impracticable for irrigation purposes.

HERDSMAN'S LAKE DRAINAGE.

17° GEO. V., No. IX.

No. 9 of 1926.

AN ACT to repeal the Herdsman's Lake Drainage Act, 1920.

[*Assented to 7th October,* 1926.]

BE it enacted by the King's Most Excellent Majesty, by and with the advice and consent of the Legislative Council and Legislative Assembly of Western Australia, in this present Parliament assembled, and by the authority of the same, as follows:—

Repeal of Act No. 23 of 1920.

1. The Herdsman's Lake Drainage Act, 1920, is hereby repealed.

Figure 21: Act to repeal the Herdsman's Lake Drainage Act, 1920.

The scheme was flawed from the outset, and was eventually abandoned. With the completion of the works in 1926 the Act was repealed (Figure 21). The Lake was thus allowed to refill as the venture proved to be uneconomical. It became in effect a large fen invaded extensively by *Typha* (McComb & Lake, 1990).

6.5 Summary

Past land uses have caused significant environmental degradation to Herdsman Lake. Drainage systems, agriculture, fire and market gardening have resulted in severe modification to native flora and fauna thus the landscape. Vast sums of money were spent to encourage the Returned Soldiers to take up market gardening on the reclaimed land following World War I. By 1935, the Government had spent nearly £150 000 in attempting to establish settlers. The peaty soil of the Lake subsided and there was a failure to heed warnings that the soil was problematic. The Lake became an extensive marsh covered with peat, and in winter, because it never completely drained it became a 'vast bog' (Groves, 1997).

Since the 1930s pressures of urbanisation have gradually led to the encroachment of residential and industrial developments surrounding Herdsman Lake. However, despite these impacts Herdsman Lake remains an important wetland on the Swan Coastal Plain. It is inclusively conserved and used for educational purposes by the Gould League of Western Australia. Today the conserved area of the lake is approximately 400 hectares in area and comprises of a variety of landscapes including permanent water bodies, seasonally dry wetlands and open parkland. It supports a wide diversity of wildlife species, and is a significant breeding ground and a summer refuge for migratory birds.

The next chapter discusses the impact of European settlement at Lake Joondalup twenty kilometres north of Herdsman Lake.

Chapter Seven:
Lake Joondalup

7.1 Introduction

Lake Joondalup (the largest lake in the northern suburbs of Perth) is located within the area now known as Yellagonga Regional Park, which is located approximately 20 kilometres north of Perth 31° 45'S, 115° 47'E (Figure 1). The Lake is situated within the coastal limestone belt of the Swan Coastal Plain. 'It is a typical linear lake which occupies an interdunal depression approximately 8 kilometres long and 1.2 kilometres wide at its broadest point, with an open water surface of 6.1 square kilometres' (Water Authority, 1986, p. 66).

The study area is primarily focused on a wetland system that includes Lake Goollelal (Figure 23) (south of Lake Joondalup) and Beenyup Swamp (Figure 24) and Walluburnup Swamp (Figure 25) as well as Joondalup itself (Figure 22). The wetlands encompass some of the last remaining freshwater systems on the Swan Coastal Plain. Surrounding the Lake there is a wide range of ecosystems, including fringing woodlands, sedgelands and parkland.

Figure 22: Lake Joondalup.
Source: Author, October 2012.

Note: Lake Joondalup has a high conservation value as an important breeding ground and a summer refuge for a diverse bird population some of which are trans-equatorial migratory wading birds. The surrounding woodlands also provide habitat for a diversity of bush birds. The bulrush (*Typha orientalis*) is impacting on the native ecosystem. However, it provides shelter, nesting sites and food source for native fauna.

Figure 23: Lake Goolellal.
Source: Author, October 2012

Note: There are significant beds of jointed twig rush (*Baumea articulata*) around the shores of the Lake ideal for nesting sites and refuge for numerous waterbirds. Surrounding woodland also provides habitats for a diversity of bush birds. The Lake is considered to have a high conservation value.

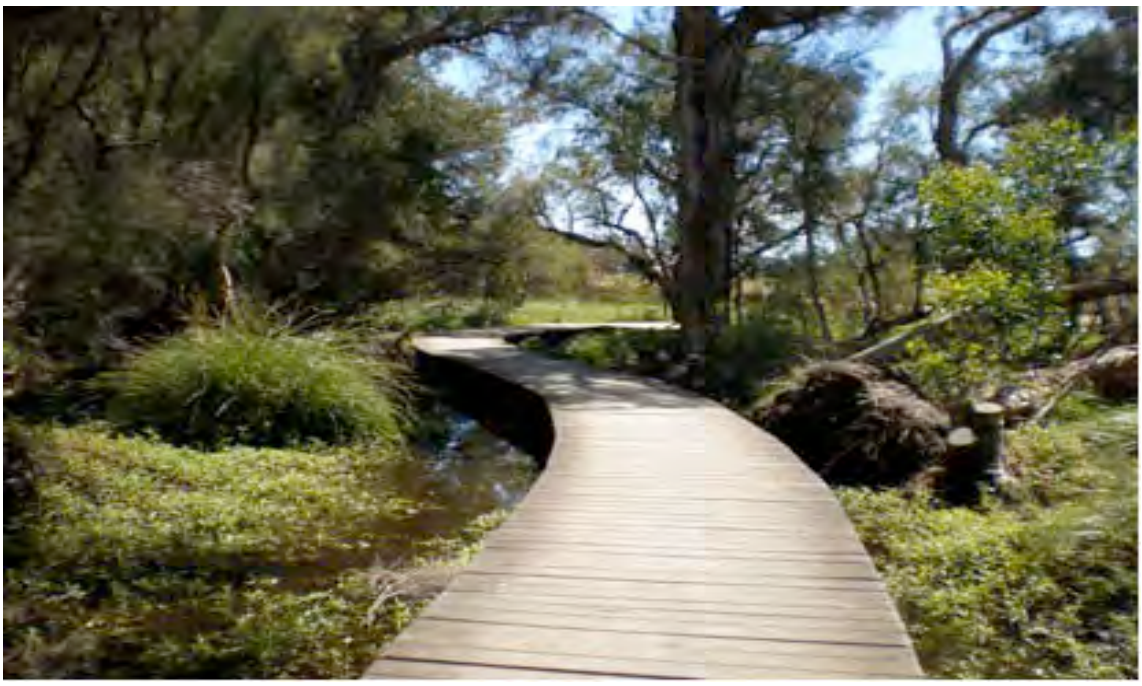

Figure 24: Beenyup Swamp.
Source: Author, September 2012.

Note: Beenyup swamp is the smaller of the two swamps with dense vegetation, representing wildlife environment that has been relatively unchanged by humans. It is the richest site on the Swan Coastal Plain for invertebrate fauna. The walkway was erected to enable the public to observe and appreciate the natural beauty of the wetlands.

Figure 25: Walluburnup Swamp.
Source: Author, September 2012

Note: Walluburnup swamp contains the oldest grown peat fill on the Swan Coastal Plain. The swamp is mostly degraded as the result of timber clearing by the early European settlers, market gardening and horse and cattle grazing. The row of olive trees to the right of the photograph are approximately 160 years old and were planted by the early European settlers.

7.2 Indigenous occupation

The Nyoongar indigenous people called the Lake *'Doondalup'* or *'Borrarribup'*. Areas around the Lake form part of their 'Dreaming', that is their concept of spirituality, and associated with this are areas of mythological, ritual and ceremonial significance (discussed in Chapter 4).

The Lake was an important camping site for the local Nyoongar indigenous people. They used it for watering, food gathering, hunting and corrobories and summer social life. Due to its centrality within the Mooro district it was ideal as a campsite. Lake Joondalup and surrounding areas were an 'east-west's staging point between the foothills and the ocean, and a north-south staging point between Mount Eliza (now known as Kings Park) and Moore River' (Brittain, 1990, pp. 1-2). However, Brittain (1990) suggests that they did not continue to use at the Joondalup site after 1829, due to the sub-division of their land into pastoral leases.

The first recorded excursion to the area surrounding Mooloore Lake (now known as Lake Joondalup) was in 1834, by European settler John Butler searching for lost cattle. He reported seeing large lakes, a haven for wildlife. Butler submitted a written report to Governor James Stirling, saying:

> We feel confident that we can safely recommend that a proper surveyor be sent well equipped for the service of at least three weeks when we feel assured that he will be successful. (Chambers, 1991, p. 1).

Journals of early European explorers also offer descriptions of Lake Joondalup. One of the first known visual accounts of the area was by Lieutenant (later Sir) George Grey (1837-1839, pp. 89-92):

> The country through which we were travelling is intersected by a long line of lakes, which run nearly parallel to the sea for a distance of about forty-five miles…we suddenly come out on the bed of a dried up swamp, looking like a desert of white sand studded with reeds. The forms of natives were seen wandering about this, one mile from us, who were searching for frogs…Anxious questions were put by the men, as to their distance from Perth, and the natives all told them they would see it the next morning, whilst the sun was still small.

In 1837 Surveyor General, John Septimus Roe, sent Thomas Watson 'to perform by contract a survey of the entire boundaries of the lakes…in the hope that it would draw a population towards the spot'. As a consequence of Watson's survey several Swan settlers took up 1400 (567 ha) of land around Lake Joondalup. However, it as never their intention to settle, their main objective was to secure land for speculation. It

was part of the 'land-grabbing syndrome', mainly carried out by the well-off early settlers (Russo, 1998, p. 115). The settlers 'sought to grab extensive parcels of land to gain political and economic power and have a life they had, or would like to have had, in England (Russo & Schmitt, 1987, p. 10). Although they did not establish any permanent settlement or plant crops they used the land for cattle (Gilks, 1977).

Grey describes meeting with the Nyoongar indigenous people of the area (1837-1839, p. 292):

> Nov 30th 1838 Mr. Smith and myself started at noon this day, accompanied by Corporal Auger and two natives, upon a trip in a northerly direction, about 5 p.m. we reached a lake about fifteen miles from Perth, and called by natives Moorloore, the horses were scarcely tethered and our fire made, when four more natives joined the party…they brought as a present of twenty-seven fresh water tortoises…They said that although the lake was called Moorloore, the name of the land we were sitting on was Doondalup.

George Grey carried out further surveys in 1838 and had no hesitation in recommending the land for future settlement (Russo, 1998). Grants of one thousand acres were leashed around Lake Joondalup for pasturing cattle and horses (Gava, 1978). The area around the Lake with good land, peaty quality of the soil and excellent water-holding capacity made it an appealing proposition for the new settlers (Gilks, 1977). However, due to access difficulties the area remained comparatively unchanged, as it had no rivers, and its lakes were too far apart to act as waterways (Aris, 1997).

7.3 Early years of settlement

In the early years of settlement, farming around Lake Joondalup was not regarded as a viable proposition because of its isolation from Perth. The rough tracks had to be negotiated by bullock team, the settlers often leaving at sundown and not arriving in Perth until the following afternoon. Despite the distance, land was purchased, and by 1838 a small number of settlers were living and working in the area. Their main occupations were dairying and market gardening, with grazing on Crown Land as an added venture (Gilks, 1977). The farms tended to be small; therefore the initial impact upon the ecological balance was minimal.

There were two main types of market gardens, those established on sandy soil, and those established in the swamps. The black and naturally fertile swamp soil kept its moisture throughout the year; however, due to the cultivated areas being divided into beds with channels separating each bed for drainage the use of large machinery was

impracticable. Therefore work had to be achieved by digging with spades, or small ploughs (Gilks, 1977).

As a means of supplementing the early settlers income, timber cutting took place throughout the area. The isolated settlers had to be able to undertake a wide range of occupations to augment their meager incomes. Many worked part-time cutting wood and shooting kangaroos, timber felling, fencing and shearing (Russo, 1998).

The natural bush land, with jarrah (sometimes known as Swan River mahogany) and tuart, was found to be ideal for the development of a timber industry. Timber was cut for firewood, roadblocks, fence posts and building materials. On the eastern side of the Lake numerous trees were also felled for the construction of packing cases for produce from the local market gardens. Although most of the wood was used locally, a considerably quantity was exported (Gilks, 1977). This action was symbolic of the prevailing attitudes of the settlers to the environment.

Other settlers made a different kind of living out of the natural vegetation. Notably, itinerant 'palm-wool' pickers collected the soft-downey material found at the base of the zamia palm (*Macrozamia reidlii*), which was then used as filling for mattresses and pillows (Figure 26). By using natural resources they made little impact to the ecological balance of the environment. However, as the demand for their produce lessened they sought employment elsewhere (Menchetti, 1972; Gilks 1977).

Figure 26: Zamia palm (*Maccrozamia reidlii*).
Source: Author, September 2012.

Note: The 'palm wool' pickers used the soft down-like material found at the base of the palm for filling pillows and mattresses.

7.4 Mission school

In 1843 Rev. John Smithies, a Wesleyan Missionary, attempted to establish a Native Experimental Farm on the northern shores of Lake Goollelal. The Mission Farm was to encourage the indigenous people to learn agricultural skills. 'Smithies plan was to teach the Aborigines the fundamentals of agriculture while supporting the project by the crops produced' (Gilks, 1977, p. 20). By 1844 a quantity of maize, melons and potatoes was planted. Because of their hardy nature, melons and potatoes grew well. Unfortunately maize did not thrive due to poor soil conditions and lack of fertilizers. Despite poor crop results Smithies was determined and by 1846 he had six hectares under cultivation. However, in 1847 flooding spelt disaster for the mission. Crops rotted in the ground and most of the work achieved over previous years was at an end (Green, 1984). The farm was relocated to York in 1851.

7.5 Early settlement during the 1840s

During the 1840s there were a number of early settlers established around the shores of Lakes Joondalup and Goollelal. These were labourers who found their services in high demand and after four years honest work at fair wages; many saved enough to set up for themselves in small farms, with the certainty of future independence (Ogle, 1939). However, the distance to Perth and the markets was a factor limiting the productivity, and, therefore, the settlers' well-being. There was a need to break down the isolation. The sandy track to Perth made travel extremely difficult. As the number of farmers increased, pressure grew for the construction of a main road linking Perth to the settlements around the Lakes (Gilks, 1977).

In an attempt to overcome this problem, a 'block road' of jarrah was constructed (Figure 27). Between 1850 and 1875 convicts were brought to the Swan River Colony to overcome the labour shortage (Brittain, 1990). From 1871 to 1875, after earning their ticket-of-leave, twenty convicts were employed to construct the road. The road was 2.7 metres in width and the jarrah blocks were approximately 45 cms in diameter and 20 cms thick. The blocks were laid with sand poured in between them. They were laid to match the tracks of the vehicles wheels. However, while it made travel possible it made for uncomfortable travelling and there was constant need to repair the road (Daniel, nd)

Figure 27: Jarrah wooden blocks being laid at Wanneroo Road south of Wanneroo town site in 1902.
Source: Joondalup Local History Library (No: 2.24).

Note: The basic equipment used for felling the many jarrah trees, which were abundant at the time in the area.

7.6 Agricultural settlement

In the 1870s the Chinese were the first large commercial gardeners on the swamps and around Lake Joondalup. Relying on the swampy organic soils where water was freely available and the soil was black and humic, they remained the dominant influence in market gardening until the 1920s (Gava, 1978).

By 1872 there were approximately sixty families in the area, with development mainly to narrow strips of land surrounding Lakes Joondalup and Goollelal (Gava, 1978). In the 1880s pastoralism developed around Lake Joondalup. Those with grants needed to safeguard their stock by taking out pastoral leases. Previously the settlers had utilised Crown Land without authority (Brittain, 1990).

In 1893 the Wanneroo area was recorded in the *West Australian Directory* as an agricultural settlement. Eight farmers and four farmer-grazers are recorded as residents. They were men with limited capital who bought cheap land to establish 'small peasant agricultural type holdings' (Gilks, 1977, p. 90). However, before cultivation was possible, large areas of land had to be cleared. Clearing of the heavily timbered areas was time consuming and made heavy demands on labour. Tools brought from their

country of origin were not suitable against the hard West Australian timbers (Cameron, 1981).

Therefore it became practice to burn scrub from around homestead sites and areas for cultivation, destroying much of the native bushland. New techniques had to be found. 'Ringbarking' became the accepted practice for the removal of trees; this was done in winter and spring and the trees were felled the following spring. The procedure was to stack light brushwood at the base of the ringbarked trees and then set alight (Cameron, 1981). Although the accepted method for removal of trees represented progress in productivity techniques, it clearly shows how little the early settlers appreciated or respected the native flora and fauna.

Smoke haze caused by the fires covered the coastal plain throughout the summer months. It was not until September 1847 an attempt to control burning by legislation was implemented. Fire bans were imposed from September to April (Cameron, 1981).

The early days of settlement saw areas surrounding Lake Joondalup used for recreational purposes. Members of the 'aristocracy' of Perth and officers from the Garrison of the Colony travelled to the area to hunt kangaroo and wildfowl. As the area became more settled, race meetings were established at Perry's Paddock on the shores of Lake Joondalup (Gilks, 1977).

As pastoralism developed in the area those with grants needed to protect their stock by taking out pastoral leases. A Stock Route 800m wide passed along the western side of Lake Joondalup. Cattle were driven along the Stock Route between Murchison River and Perth thus providing a link between the leases and the Perth markets (Figure 28). Where water was not accessible wells had to be sunk at one day's droving intervals and declared as watering points or stopping places for stock and itinerant shepherds and travellers (Russo, 1998).

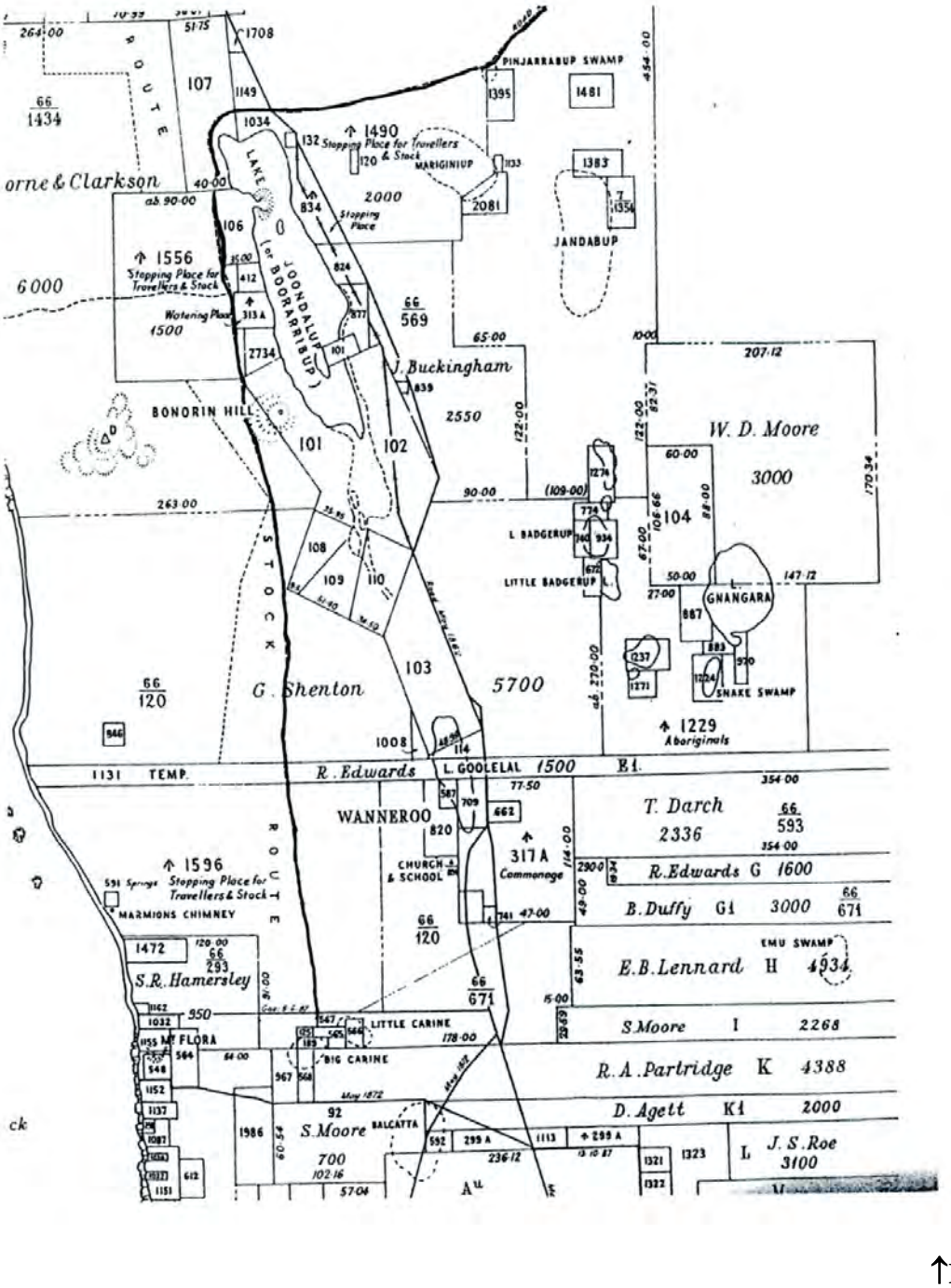

Figure 28: Cadastral map showing land subdivisions near Lake Joondalup in 1890. Stock Route passing along the western edge of the Lake.
Source: Chambers 1991, p.xvii.

Note: The various watering points for travellers and stock from Perth to Murchison River.

Cheap lakeside land made it an attractive proposition for the early settlers (Gilks, 1977). In 1893 the area was recorded as an agricultural settlement.

The early settlers first became aware of land around Lake Joondalup which indicated the land was already suitable for farming or market gardening as detailed in the *Inquirer and Commercial News* January 1903:

Farming property Wanneroo Road

> Freehold lands magnificent swamp and grazing land 18 miles from Perth, area 1.118 acres. Well fenced and improved. 30 acres of rich swampland grow anything.

Land clearance commenced in the same year with the first permanent settlers utilizing the natural resources on the shores of Lakes Joondalup and Goollelal for market gardening and dairying.

According to Simpson's 1903 map (Figure 29) land subdivision around the Lakes shows that 'apart from two substantial blocks of Crown Land, all the surroundings right up to the water's edge were in private hands' (Gentilli, 1998, p. 297). The settlers gradually transformed the natural landscape, and in some areas actually impinging onto the lakes changing, they're configuration and the extent of open water.

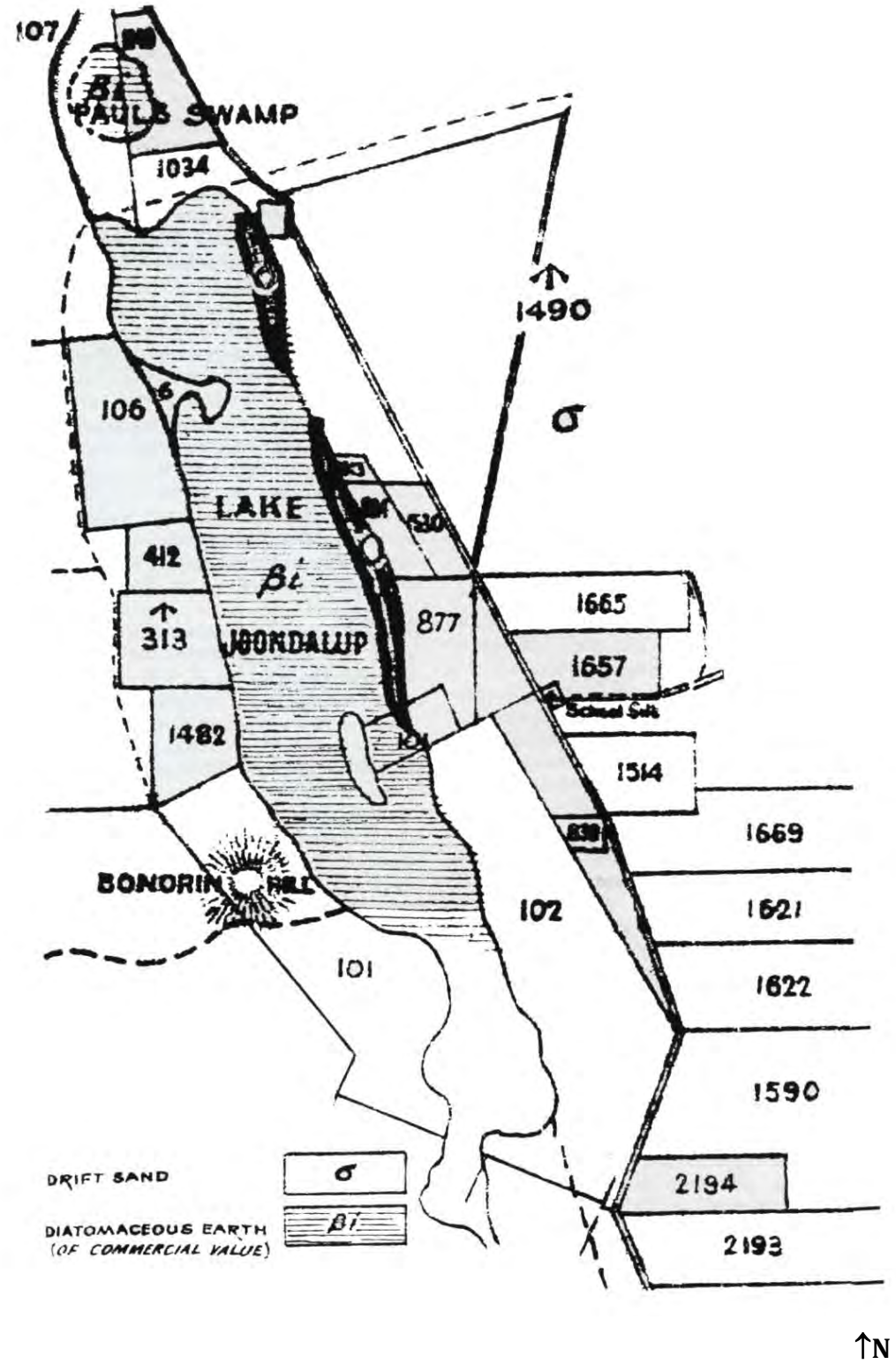

Figure 29: Simpson's Map 1903.
Source: Gentilli, 1998, p. 299.

Note: Lake Joondalup and surroundings in 1903. The lake bottom (southern part not seen)is covered with diatomaceous earth "of commercial value". Along the eastern shore there was a narrow strip of open water. All the surrounding land had been subdivided, and only two parcels belonged to the Crown (Gentilli, 1998, p. 299).

As settlers cleared the surrounding bush, and cattle were allowed to graze and waterholes were fenced off this limited the amount of grazing needed for the kangaroo and other native species making it difficult for the Nyoongar to continue their traditional way of life. As a consequence of this displacement the Nyoongar relocated in search of a more favorable environment (Gilks, 1977). Many moved further north to Moore River whilst others made an attempt at integration, engaging in occasional work for the settlers.

7.7 Lime burning industry

Another profitable exploitative industry around 1910 was lime burning. It began along the western escarpment of the depression, which contains the linear chain of lakes. Limestone outcropping manifests itself in reefs, coastal cliffs and inland ridges. It was an extremely valuable commodity. Lime was used for making building mortar, plaster, paints, cement and for lime-sand brick manufacturing, whitewash, tanning and glass manufacturing. The preferred fuel for burning in the kilns (Figure 30) was jarrah, tuart and redgum timber. The timber was cut and carted by local people or full-time contractors from private land, or from State forests. Molyneux (1981, p. 1), noted:

> Within the Shire is an important association of limestone-walled, timber roofed buildings and timber-fired limekilns, all intimately related to lakes and limestone land forms. The buildings relate to small-scale, labour intensive primary industry.

The lime burning industry was an occupation in which local residents could find employment to supplement their income. From the 1920s Wanneroo became the site of major lime producing industry in Western Australia. At the peak of production there were approximately 47 kilns operational and 200 people employed in quarrying, supplying timber and carting. The kiln workers were of various nationalities, living close to the kiln sites (Molyneux (1981). Early settler Roy Ostle recalled his experiences whilst working for the Perth Lime Company:

> When we emptied the kiln…I think from memory we used to get two hundred bags of lime at a time, two hundred and ten, something like that…we pulled the galvanised iron out and then we'd start bagging the hit lime, it would be still hot, if you didn't' watch it'd burn the bags. The dust used to settle all over you, it's that hot in there, everywhere you sweated it burnt you…around your waist, under your belt, your boots, your feet, your hands. Every finger had bandages on and you couldn't stop. You just had to keep working…Once you started sweating and grabbed a bag to tie it up the skin would tear off your fingers because the lime had eaten the skin away and you'd have raw fingers just grabbing the bags…you'd get this about three times a

> week, as soon as you'd emptied one kiln you'd fill it and start again. (Utilising oral sources Joondalup History Collection. E217 1996).

Living conditions were very basic for the workers. Lime worker Roy Ostle discusses his living conditions whilst working for Perth Lime Company:

> I lived in a bagged shack I built meself [sic], white washed with the lime we burnt. Every now and again we would give it another coat of white wash and make out we had a new house. (Utilising oral sources Joondalup History Collection 1996).

The lime industry thus had a profound effect on the cultural landscape through the construction of the kilns and worker's huts, the quarrying, and the clearance of timbered land for fuel.

Figure 30: Limestone Kilns – Wanneroo Road, Neerabup.
Source: Author, September 2012.

Note: Kilns were generally built at quarry sites, usually at the down hill edge of the quarry floor, positioned so that stone could be loaded into the top of the kiln shaft and the burnt lime unloaded from the bottom onto a bagging floor (Molyneux, 1981).

7.8 Introduction of new crops

In the 1920s, the next movement to the area looking for cheap land was by the Italians and other Southern European migrants with names like Sinagra, Ariti, Conti, Villanova, Luisini and Parin. The Italian migrants contributed to the expansion of the Western Australian economy by cultivating poor land, and changing a poor holding into

an enterprising project, which was beneficial for the whole community (Gilks, 1977). They had heard of the opportunities and were prepared to put up with the hard work and isolation. 'Their whitewashed hessian huts were framed in rough bush timber with stone fireplaces and secondhand corrugated iron held down by logs' (Brittain, 1990, p. 73).

In 1924, Italian migrant Ezio Luisini planted the first commercial vineyard on the eastern slopes of Lake Goollelal and established a winery. 'The origins and operation of the winery and its role in the development of Wanneroo is closely tied to the life of the Italian community and their market gardens' (Palassis Architects, 1996, p.1). The winery reflects the predominant activity, which flourished until the 1960s when it succumbed to urban development.

The wetland areas became major producing centres for fresh fruit and vegetables. The migrants were accustomed to demanding agricultural practices in their homelands. 'Their occupations were of an unskilled nature and matched the areas of previous settlement' (Gava, 1978, p. 102). Therefore with little capital and small allotments they worked their land with family help and by the end of the 1920s they were foremost market gardeners in the area (Gava, 1978). Introducing crops that were suitable to the soil, thus overcoming soil and drainage problems. They were able to grow sweet potatoes, pumpkins and melons. The soil remained moist enough to render irrigation unnecessary and the crops thrived with the introduction of fertilizers (Gava, 1978).

In the late 1920s, a record high water-table level-flooded market gardens around the Lakes. To alleviate this problem local market gardeners shored-up caves in the north-west shore of Lake Joondalup on the understanding the Lakes would drain into the sea through a labyrinth of caves (Figure 31). Their efforts were insufficient although the channel remains today.

Figure 31: Caves on the northwest shores of Lake Joondalup excavated by early settlers to drain water from Lake Joondalup through a labyrinth of caves to the sea.
Source: Susanne Koepke, September 2008

Note: The timber for the cave would have been cut down from surrounding areas.

Prior to 1929 market garden produce was handled by a Growers Co-operative, which authorized gardeners to sell directly to the public. In 1929 the *Metropolitan Marketing Act* was passed allowing garden produce to be sold at the Wellington Street Markets in Perth (Gilks, 1977).

In the 1930s there was a heated debate over the use of arsenic as a pesticide by market gardeners applying it to their vegetables. The growers were worried over the restrictions that could inconvenience their livelihood (Gava, 1978). The *West Australian* 13th July 1933 reported:

> It was argued that a Mr. Bob White had masticated one of the cabbage leaves dusted with arsenic and pronounced unfit for human consumption in the presence of the marketing inspector and a crowd of interested spectators and had remained very much alive.

However, the various government departments concerned did not help to clarify the position having unable themselves to agree on the effects of using arsenic. Therefore the local authorities introduced a limitation on the use of arsenic within a month before picking (Gava, 1978).

7.9 New methods of improving cultivation

New types of artificial fertilizers improved the soil making it capable of supporting successful crops. The introduction of tractors increased production and cut down on the use of manpower. Market gardeners were adapting to new mechanical approaches. However, as demand for housing grew, it was no longer viable for market gardeners to retain land. They moved out of the district to seek cheaper land elsewhere.

7.10 Summary

The development of the Wanneroo area around Lake Joondalup only took place after competition from land closer to Perth caused land prices to rise. Potential land buyers looked north of Perth for cheaper land. Early settlers, with little capital, bought cheap land that suited their purposes and worked to establish a successful enterprise, thereby causing the district to develop. The early European settlers of Wanneroo were true pioneers, developing a district and an industry that was essential for the healthy growth of the area. The money economy of the young colony encouraged the exploitation of the natural resources of the area – lime, forests and soil. The settlers brought with them memories and experiences and pursued a lifestyle that originated from their homelands. However, these memories and experiences could not always be easily transferred to the Australian landscape (Seddon, 2004).

Chapter Eight:
Loch McNess

8.1 Introduction

Loch McNess (originally known as Lake Yanchep) is located within the area now known as Yanchep National Park. It is a vital link in a chain of wetlands 50 kilometers north of Perth at 31° 32'S, 115° 41'E (Figure l). The Park is 8.4 kilometres long by 4.1 kilometres wide at its northern end, and covers an area of 2799 hectares. Subterranean waterways and cave lakes occur in the area. 'Caves occur in fractured limestone upland surrounding the Lake' (Usback & James, nd. pp. 10-55).

Figure 32: Loch McNess.
Source: Author, September 2012.

Note: Loch McNess a tranquil lake that provides an important summer refuge and habitat for many waterbird species dependant on permanent wetlands. The fringing vegetation is ideal for nesting and refuge.

The name Yanchep is of native origin and is probably derived from the 'yanchet' or 'yanjidi' indigenous name for the reed (*Typha orientalis*) (Figure 14), which is abundant around the Lake (Gentilli, 1998). They were regularly burnt to improve growth, and the roots were crushed into a paste and used as a type of flour (Hallam, 1975), as (discussed in Chapter 4).

8.2 Indigenous land use

The Nyoongar for thousands of years were well acquainted with many of the lakes and caves and gave them distinctive names. The process of naming a locality has the effect of adding meaning to it, which serves to strengthen established cultural meanings.

> Every part of the environment was named by Nyoongars to indicate how and where the part belonged in the whole interconnecting county of lakes, swamps, streams, soil types, animals, birds, insects and vegetation. Through names, people identified and related to the place, its history, their origins, and the significance of the origins and the connections of every location in the landscape. Place names helped keep obligations to neighbours as well as themselves to protect food and water supplies (Cunningham, 2005, p. 145).

Because of good water supplies, and the availability of flora and fauna Loch McNess was a valuable camping site during the dry summer months for the Nyoongar, they would gather for watering, food gathering, hunting, corroborees and rituals that governed their tribal lives (Gentilli, 1998). Indigenous groups from as far north as Moore River and south to the Swan River groups that were closely linked to each other regularly used to meet in the area.

8.3 Nyoongar traditional beliefs

Loch McNess is a mythological site for the Nyoongar indigenous people. According to their traditional beliefs, the waugyl (Rainbow Serpent) inhabited the Lake. O'Connor, *et al*, (1989, p.24) state: 'it is through the activities of the waugyl that the springs, which feed the Lake, continue to flow. Should he be killed, according to tradition, Loch McNess would dry out completely'. The Nyoongar did not venture too close to the Lake's perimeter for fear of the waugyl**.** Gentilli (1998, p.281) documented that 'the Aborigines association with the Yanchep area was not a completely happy one, despite its abundant water and game, because it was believed to be the home of the Waugyl' (Figure 16).

In 1847 Landor (1847, pp. 210-211) described a tale of two spirits, one of which is specifically associated with the pools and limestone caverns of the Yanchep area:

> Besides Chingi, the evil spirit who haunts the woods, there is another in the shape of an immense serpent, called Waugul, that inhabits solitary pools…One day, whilst bivouacking at a lonely and romantic spot, in a valley of rocks, situated some forty miles north of Perth, called Dooda-mya, or the Abode of Dogs, I desired a native to lead my horse to a pool, and let him drink. The man, however, declined with terror, refusing to go near the pool, which was inhabited by the Waugul. I therefore had to take my horse myself to the spot, whilst

> the native stood aloof, fully expecting that the Waugul would seize him by the nose and pull him under water.

George Fletcher Moore also described the waugyl as. 'An imaginary aquatic monster, residing in deep dark waters, and endowed with supernatural powers, which enable it to overpower and consume the natives…Its supposed shape is that of a huge winged serpent' (cited in Bourke, 1987, p. 8).

8.4 Landforms and vegetation

For many centuries numerous springs discharged from the nearby limestone into Loch McNess, which, combined with the rich soil produced an abundance of flora (Shapcott, 1933). 'It has been suggested the Loch McNess is a water-filled, collapsed underground cavern or series of caverns. However, it is more likely that it is an area where the water table is exposed expressing itself as a Lake' (Department of Conservation and Land Management, 1997, p. 13).

The wetlands are directly associated with the underground water table known as the Gnangara Groundwater Mound. Geomorphologically, the area forms part of the low-lying, gently undulating Swan Coastal Plain, which was built from 'accumulations of aeolian (wind deposited) and alluvial (water deposited) sediments' (Seddon, 2004, p. 106).

The area surrounding Loch McNess is described by (Gentilli, 1998, p. 282) as:

> It consists mainly of aeolianite limestone; it is characterised as a landscape by an almost continuous crust of travertine, perforated by solution pipes and by numerous caves. There is a complicated system of subterranean water circulation, partly by direct flow through caves, partly by lateral seepage.

The landforms, rocks and soils of the area are varied and complex, consisting mainly of sand and karst features (Seddon, 2004). Within the area there are over 1000 caves, which provide a wide range of habitats for a variety of fauna and flora.

Vegetation surrounding Loch McNess is representative of those of the northern coastal plain. Beard (cited in Williams, 2003, p. 109) stated that 'predominately the vegetation is representative of the Spearwood Dune System; but some of it is more characteristic of the drier Jurien System, and in some areas, the coastal Guilderton System'. 'The general appearance of the vegetation landscape ranges from heath land to woodland, with wet-land and dry-land species associated with varying depth and quality of soil' (Gentilli, 1998, p. 285). The most noticeable in the area is the tuart.

8.5 Early observations of the landscape

Explorer Lieutenant (later Sir) George Grey published some of the earliest observations of the landscape surrounding Lake Maubeebee (Mambibby). He was the first European to leave a written record of his travels. These early observations give an insight into the wetlands transformation through time. While making a short expedition to the north of Perth in 1838 Grey, accompanied by Frederick Smith and Corporal Auger followed the chain of linear lakes which run in a northerly direction along the coastal strip. The party camped at a lake called Maubeebee (Mambibby) they described the land as an 'oasis in the hot, dry Australian bush'. Maubeebee today is now known as Loch McNess and is the central feature of Yanchep National Park. Grey (1841.vol. 2, p. 297) describes the beauty of the lake:

> We were sitting on a gently-rising ground, which sloped away gradually to a picturesque lake, surrounded by wooded hills, whilst the moon shone so brightly on the lake that the distance was perfectly clear, and we could distinctly see the large flock's of wild-fowl as they passed over our heads, and then splashed into the water, darkening and agitating its silvery surfaces.

Surveyor General John Septumus Roe describes in detail on the 15th October 1841 the terrain of the area mentioning the rocky stony outcrops surrounding Lake Mambibby (now known as Loch McNess) (Figure 33). However, his map of 21st May 1841 shows grassland and extensive open downs with good grass (Figure 6). He is clearly evaluating the land with a view to its possible use by settlers.

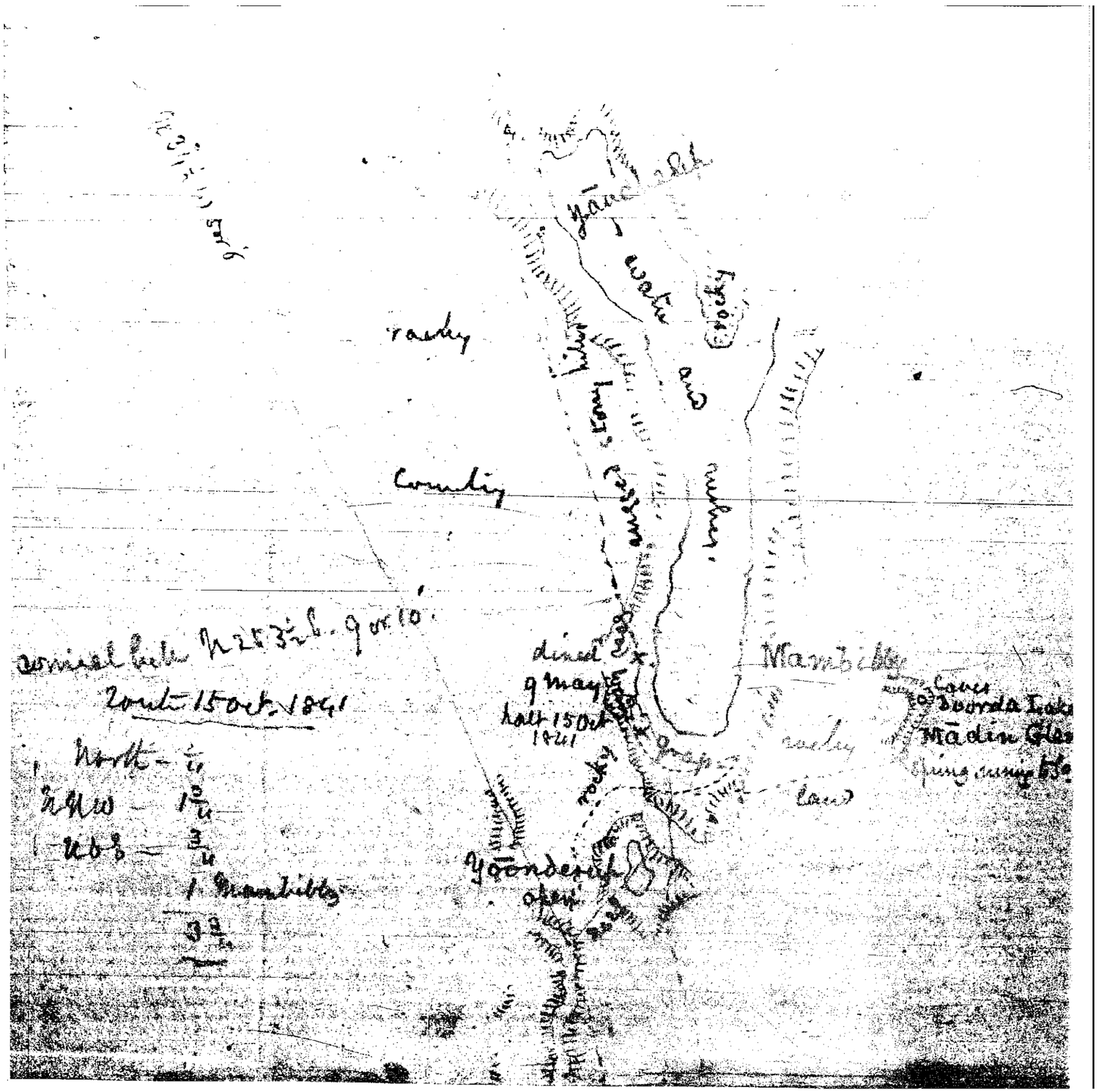

Figure 33: Surveyor General John Septumus Roe's map describing in detail the terrain at Yanchep 18th October 1841.
Source: State Records Office of Western Australia.

8.6 The discovery of caves

On 15th October 1841, Roe discovered and explored caves in Boomerang Gorge; he observed:

> In several parts of the lowest level of this cave and of most of the others we examined, a fine stream of delicious water was running mostly to the southward and disappeared underneath a very low fissure in the rock, beyond which it was impossible to trace it. (cited in Chambers, 1991, p. 2).

'Unable to resist a souvenir of two, Roe and Hutt emerged from the cave with stalactites in their hands' (Elliot, 1977, p. 11). 'The natives were convinced that the stalactite was a tooth of the dreaded 'chinghah' or 'evil spirit' (Moloney, 1979, p. 5).

Explorer Lieutenant (later Sir) George Grey (1841, vol. 2, pp. 308-309) also observed and noted several remarkable caves:

> I left the main party with two natives, and travelled up a swampy valley, running nearly in the same line as the chain of lakes we had followed in going north. The natives insisted on it, that these lakes were all one and the same water; and when to prove to the contrary, I pointed to a hill running across the valley, they took me to a spot in it, called Yun-de-lup, where there was a limestone cave, on entering which I saw, about ten feet below the level of the bottom of the valley, a stream of water running strong from S to N in a channel worn through limestone. There were several other remarkable caves about here, and one of which was called Doorda Mya, or the Dog's house (Figure 34).

Figure 34: Doora Mya (Dog's house) Yanchep.
Source: Author, July 2011.

Note: So named because dogs (most probably dingoes) congregated there seeking out the small kangaroos, which were to be found sheltering in the cave. Surveyor General John Septumus Roe's map indicates the Doora Mya cave during his travels 15th October 1841. (Figure: 33).

Although straying cattle may have brought the occasional searcher into the Yanchep area, the remoteness prevented human habitation at this early time. The area surrounding Loch McNess was the feeding and watering point for cattle being driven along the Stock Route (Figure 28). In the 1860s stockmen began passing through Yanchep using the Murchison Stoke Route (according to government maps the name is unofficial). Stockmen and kangaroo shooters were the only Europeans in the Yanchep area during this period (Russo, 1998). Stockmen used the area as a place to replenish their food supply and water and feed their animals. Many tales were told about the numerous caves. However, the stockmen were not interested in them. The Stock Route continued in use until 1929, when application was made for the release of some portion of the land because it was felt to have outlived its usefulness (Gilks, 1977).

8.7 Early occupation by European settlers

The first major transformation to the Yanchep landscape occurred in 1901 when Henry White, an early European settler, selected land for cattle grazing. He built the first permanent building, which became his home and was later to become McNess

Hostel (Pidgeon, 1990). White was made honorary caretaker and to augment his income he found it a profitable proposition showing tourists through the most remarkable caves (Chambers, 1991). By 1903 most of the major caves had been explored, named and recorded:

Name of Cave	**Discovered by**	**Date**
Milligan's (Cabaret)	A.W.Milligan	1901
Yonderup	A.W.Milligan	1901
Crystal White (Crystal)	H.White	1902
Clustered Cauliflower	R.White	1902
Surprise	P.Cheese	1903
Marble Terrace	P.Cheese	1903
Yanchep	J.Grant	1903

Over the Christmas New-Year period 1902-1903, A.W.Milligan, a prominent Perth naturalist and lawyer, and his friend T.P.Draper, visited Yanchep looking for museum specimens. Milligan described the location in glowing terms, suggesting that the caves[5] should be open to the public and that consideration should be given to the following points. Subsequently a report was compiled for the Ministry of Lands:

> The preservation of existing caves; the discovery of new caves; the establishment of the lakes and its shores as a National Park and game sanctuary; and a building of a road from Wanneroo to Yanchep (quoted in Gentilli, 1998. p. 281).

Milligan also recommended the introduction of trout (*Salmo trutta*), red fin perch (*Perca fluviatus*) and carp (*Cuprinus carpio*) into the waterways. 'English perch were duly introduced to the lake, and four years later it was reported that the lakes…were swarming with fish up to six pounds in weight' (Chandler, 2000, p. 680). The following year it was decided trout, rather than perch should be introduced, as it had been successful scheme in the Southwest of the State (Chandler, 2000). *The West Australian* (25 June 1937, p. 14) reported:

> The black swans, pelicans and wild ducks at the resort were not interfering with the trout, as the shallow waters on the far side of the loch provided them with any number of gilgies, frogs, insects and other food.

[5] Caves have a complex and delicate environment in which the main elements are air and water flow, soil permeability, rock composition and solubility, air and ground humidity and temperature, and a balance of oxygen and carbon dioxide (Gentilli, 1998, p. 291).

In 1905, to protect the fragile structures within the caves and the unique flora and fauna the Lands Department officially gave title to this landscape. It became Public Reserve Number 9868. An area of 5640 acres was gazetted for 'the protection and preservation of caves and flora and for a health and pleasure resort'. The Park was now officially recognised as an area of conservation. (Department of Conservation and Land Management, 1989-1999). The idea was for people other than the elite to have access to recreational land to ensure the good health of the city-dwellers, notably the working class. 'A dominant attitude during this period was the assumption that nature needed to be improved upon by human intervention' (Chandler, 2000, p. 677). These ideas, created an ideal climate for the promotion of Yanchep as a 'park for the people'. It was later recognised as a National Park in 1969

8.8 Early National Park development

The development of the Yanchep area commenced when the Caves Board took over management of the Park in 1906. However, efforts to develop Yanchep were unsuccessful due to distances and sandy track conditions from Wanneroo and beyond. The Board was dissolved in 1910. Due to lack of funds, little was achieved until control was transferred to the State Gardens Board in 1931 with Mr. L.E.Shapcott as Chairman (Chandler, 2000).

In 1908 an opinion was expressed by the Colonial Treasurer and Colonial Secretary reported in the *Western Mail* (1908, p. 44) 'That until this piece of road is made no great concourse of people will be able to reach the caves for week-end outings'. It was pointed out that material for making the road could be found in the vicinity; therefore the cost of the road would be comparatively small. When the road was completed 'Yanchep with its lakes and caves and surrounding country, with the sea in close proximity, would form one of the most used health and pleasure resorts' (*Western Mail*, 17th October, 1908, p. 44).

8.9 Rapid achievements 1920-1939

The development of the Park commenced after the establishment of the State Gardens Board in 1920, under the *Parks and Reserve Act of 1895*. The Board had only one member, L.E Shapcott, who was also the Secretary of the Premier's Department. The intention of the Board was to transform the landscape into a show place and to make a profit. However, Shapcott was well aware of the natural systems within the Park and the need for their protection. He therefore initiated the development of visitor facilities within clear boundaries (Chandler, 2000). 'Had it not been for Shapcott's

dream and determination Yanchep would not have developed into Western Australia's major tourist attraction of the 1930s' (Chandler, 2000, p. 690). 'Shapcott set out to develop Yanchep into a inviting 'rendezvous' of forest, lake and sea…for the people of Perth and tourists from overseas and interstate' (Chandler, 2000, p. 683).

By 1921 the Royal Automobile Club lobbied to have a suitable road built to Yanchep and in November 1925 the club organized thirty-four vehicles to visit the area. The president of the club was quoted as saying that: 'Yanchep Caves could be made a highly lucrative proposition…and would prove to be a great attraction to motorists making day trips if the road were improved' (Chandler, 2000, p. 682).

The first permanent building was completed in 1931, it was known as Yanchep House, but the name was later changed to McNess House to honour Sir Charles McNess[6]. The new structure incorporates the remains of the Hunting Lodge**,** which dates back to the 1880s. McNess House provided hostel type accommodation for visitors, with afternoon teas and meals served in the dining room (Pidgeon, 1990).

Responsibility for the Park was transferred on the 13th March 1931 from the Chief Secretary's Department to the State Gardens Board, as Class A Reserve No. 9363 for the Protection and Preservation of Caves and Flora and for a Health and Pleasure Resort (Gentilli, 1998).

On 20th December 1931, a grand opening and public viewing of the Park was held. *The West Australian* 21 December 1931, documented that 'at this opening ceremony many people were impressed with the "physical transformation" (including public amenities) that had occurred throughout the Park'.

The following newspaper article by the *Daily News* 31st May 1932 on the role of the State Gardens Board:

> To civilise the wilder moods of nature, to trim the ragged edges of natural beauty, to combat those riotous elements which would otherwise despoil the scenic charm of holiday haunts and show places, is just part of the work which the State Gardens Board has set itself out to do. For these reasons, and to care for the parks and other public resorts, which through lack of attention were smoldering to ruin, the Board was brought into being twelve years ago.

[6] Born in England in 1852 Sir Charles McNess migrated to Western Australia in 1876 where he built a warehouse for rental. He built five shops and traded as a tinsmith and ironmonger until his retirement in 1915 to enjoy travel and philanthropy, distributing much of fortune to public and charitable institutions. It was estimated in 1938 that between 150 000 and 200 000 pounds had been distributed by this benefactor during his lifetime. He died in 1938 (Brady, nd).

Before the Board had taken over, the area was frequently fired to encourage the growth of grass for stock. There was considerably damage to the vegetation and native trees (Downey, 1958).

In 1932 Crystal swimming pool was constructed by partially damming a fresh water stream from Boomerang Gorge. The quality of the water was maintained by the stream flow through the pool. It was used by a number of schools, local people and visitors. During 1936 the Australian Olympic Games team utilised the pool for training (Department of Conservation and Land Management, 1989-1999).

In 1933 the construction of The Lodge was completed. It was built as a pavilion for the swimming pool and to provide accommodation for visitors to the Park. The name was later changed to Gloucester Lodge to commemorate the visit of the Duke of Gloucester. To increase the availability of accommodation for the general public eight obsolete trams were transported from Perth and set up over Boomerang Gorge. They were converted into holiday cottages and proved to be extremely popular (Moloney, 1979)

Lake Yanchep was formally renamed Loch McNess in 1935 after the noted philanthropist Sir Charles McNess who donated eleven thousand and six hundred pounds for unemployment relief work. This resulted in the dredging of the Lake, (Figure 35) the formation of islands, the building of ornamental pools, playing fields, paths and gardens. Dredging substantially modified and deepened the southern end of Loch McNess and created man-made islands with the dredge spoil to provide an aesthetically pleasing lake with recreational boating opportunities and the flow of water for future aquatic life (Downey, 1958).

The emphasis was on pleasure and recreation. A landscape and waterscape of tourism and recreation was created on a small scale. Rowing boats and a motor launch were made available to the public to carry people on trips around the Lake. However, it was found to have detrimental effects on the Lakes ecosystem, damaging vegetation and wildlife.

Figure 35: Dredging Loch McNess. c.1930s.
Source: Joondalup Reference Library photograph No: 42.930.6.

Note: Dredging substantially modified and deepened the southern end of the Lake and created man-made islands with dredge spoil to provide an aesthetically pleasing Lake with recreational boating opportunities.

The State Gardens Board also used the donation for unemployed relief workers to work on major developments within the Park. These included extending the road from Wanneroo, supplying power and water, building internal roads and paths, fitting electric lights to Crystal Cave and establishing a children's playground.

By the mid 1930s there were a significant number of people living in and around the Park area. These were mostly people employed by the State Gardens Board in various capacities (Moloney, 1979).

In 1935 there was major construction being carried out throughout various caves with aim of opening them to the general public. (Moloney, 1979, p. 20) commented:

> Perhaps the most outstanding work done in respect to the caves was the development of the 'Ballroom' or Cabaret Cave' previously known as the 'Silver Stocking Cave'. This cave was converted into an underground ballroom while at the same time preserving its natural appearance and protecting the still 'living' formations. Bracing pillars of limestone were erected to support the roof of the natural entrance and tunnels were dug to provide an exit at ground level. A highly polished, concrete floor was laid and stone seats provided around the edges, behind which lay numerous chasms and spring waters. The area was highlighted by strategically placed concealed lighting of varied colours and apart from being open for daily inspection the cave was available for private parties.

The West Australian (14th October, 1936, p. 6) published details of the improvements to Yanchep Park:

> Satisfactory progress is being made in widening the stream at Yanchep, which leads from the rear of the crystal pool to Loch McNess. Work has now reached a point about 80 yards eastward from the bridge over the stream. This work is part of a general scheme which aims at the provision of gardens interspersed with waterways and of protected islands on which waterfowl, particularly moor hens, may breed without interruption. Progress is also being made in extending the playing field. This has now been almost completely leveled and planted with grass. Around a considerable portion of the circumference of the area a double row of poplars and willow trees has been planted. Work on the erection of the hotel is proceeding satisfactorily.

The government of the day decided that there was a large expanse of land near the Park that was suitable for market gardening. Seven five-acre lots were surveyed and leased. Clearing and leasing the land reduced the risk of fire; it also improved primary production in the area (Downey, 1958).

However, the outbreak of World War II brought about big changes to the Park. Because of the lack of resources the Park ran into disrepair and much of the manmade 'splendour' disappeared. Moloney (1979, p. 21) noted:

> Maintenance of the paths, caves and other features fell behind at this period due to a lack of labour so that by the end of the war many of the pathways, hewn out by depression labour had vanished beneath undergrowth. This is by and large, a good thing, as people in general now prefer to see natural beauty rather than that which has been constructed by man.

Yanchep National Park brings together a unique combination of Australian wildlife, vegetation and natural landscapes. It generates a positive attitude towards conservation and a greater understanding of the natural environment a 'natural oasis' in an ever-expanding landscape of encroaching urbanisation.

8.10 Summary

This chapter examined the impact the early Europeans had upon the area of Yanchep National Park and Loch McNess. It explained how their introduction of new concepts was a disruptive experience both to the indigenous people and the natural environment. The Park has been progressively modified and planted with non-indigenous trees and shrubs since the arrival of the early Europeans. However, much of the landscape of the Park is relatively unmodified which is now uncommon on the Swan Coastal Plain.

The State Gardens Board (cited in Williams, 2005 p. 9) documented that by 1939, there had been ‘approximately 10 500 trees and shrubs planted; 36 Victoria tree ferns, 114 Keysbrook tree ferns, four sacks of black, green and yellow Kangaroo paws, 153 Assorted gift trees and some 45 000 annuals’.

Motor vehicles were to significantly change the landscape, as native bush was replaced with sealed roads and car parks. To improve recreational access to the water the Lake margins were frequently burnt. This ecological imprint is a direct result of early decisions made by Europeans. ‘As urbanization spreads further in the future, its value will increase, but so will the dangers to which it is exposed’ (Gentilli, 1998, p.277). However, transport and communications brought Yanchep within easy reach of Perth, in contrast to the hazardous three-day journey involved in the half-century after its discovery.

The area surrounding Loch McNess provided, and continues to this day to provide, sustenance to migratory seasonal and resident wetland species of birds and mammals. Furthermore the land has been used for a wide variety of activities since early European settlement including cave exploration, as a health and pleasure resort, stock grazing and wartime defence. The diverse recreational opportunities provided in the Park today, include golf course, caves and wildlife enclosures and picnic facilities making Yanchep National Park a popular pleasure area- a landscape of recreation.

Chapter 9:
Conclusion and Review of Study

Research on past patterns of landscape use in the wetland depressions of the Swan Coastal Plain is of paramount importance as there has been a loss of more than eighty per cent of wetlands since early European settlement. The remaining wetlands are heavily modified.

The study attempted a two-fold comparison. First, a comparison is made between the use of the landscape by the Nyoongar indigenous people and by the early European settlers and to provide an explanation of their different attitudes and the origins of the misunderstandings by the early settlers of Nyoongar landscape use. In this way an attempt has been made to demonstrate the historical sequence in which successive occupance layers have left their imprint on the landscapes of the wetlands and their surroundings. Second, a comparison was offered amongst three separate wetland basins, differing in their distance from metropolitan Perth.

The arrival of the settlers changed the very fundamentals of the indigenous culture. The two cultures observed the landscape with different perceptions, which consequently caused contention of how the land should be utilised.

Before early European settlement the Nyoongar utilised the natural resources of the wetlands. The rich countryside and permanent fresh water was ideal as a camping site during their seasonal hunting. They collected natural foods including waterfowl, reptiles, frogs and roots. The Nyoongar practiced a lifestyle that was well suited to their environment and was ecologically sustainable. By practicing a hunter-gatherer lifestyle they developed an extremely productive system of managing the land and its natural resources, gathering sufficient food for their immediate use, but always leaving enough to generate regrowth for the future, thus maintaining the landscape's ecological balance.

The detailed knowledge of the seasonal variation of the natural plant and animal resources guided their daily activities and seasonal movements, allowing the effective utilisation of the natural resources. They relied on a rich variety of native flora and fauna, which they gathered from the land, sea and wetlands.

The quest for food demanded an understanding of the land and its resources. Before the 1830s the indigenous people influenced the environment by the use of their 'firestick farming' (discussed in Chapter 3). Through their skillful manipulation of fire, the landscape became more productive. Small localised and controlled fires were used

frequently. These had the effect of flushing out game and rejuvenating plant growth. Furthermore, the burning of the landscape of the tree-covered ridges between the wetlands facilitated the movement of the Nyoongar. Fire also produced a country free from underwood and obstructions, thus inadvertently preparing the land for the early European settlers by changing the nature of the landscape into one more suited to grazing and pastoralism.

The Nyoongar were not prepared for such a confronting realization their life and the very fundamentals of their culture and landscape would change forever.

The early European settlers brought a money economy set about transforming the landscape into one more familiar to them from their homeland. They did this by burning and cutting down native trees and by draining and filling in swamps. Also bringing with them plants and animals from their homelands, which damaged the balance of nature, and contributed, to the progressive fragmentation of the wetlands and their fragile life-support systems. They constructed fences dividing the land into separate enclosures.

Settlers found the clearing of the heavily timbered areas extremely difficult and time- consuming. Tools from their homelands were not always suitable, therefore a more effective method had to be found. Fire became the accepted method for clearing for homestead sites and areas for cultivation. Ringbarking of trees was another technique the settlers used (discussed in Chapter 7). However, compared with fire practices of the Nyoongar, the early settlers used fire to dispose of native vegetation, and prepare the land to receive exotic cultivars, cattle and to encourage the production of fodder for their livestock. The early settlers placed little value on the pristine wetlands of the Swan Coastal Plain.

Since 1829 under the influence of European culture the landscape around Herdsman Lake and Lake Joondalup have been extensively modified, reshaped and exploited for the resources they provided extracting this wealth has been achieved at some cost to the environment. However, Loch McNess in comparison has a higher environmental quality because of its relatively undisturbed landscape and distance from Perth, thus acting as a benchmark from which Lakes Herdsman and Joondalup can be compared.

Herdsman Lake is the largest lake within the metropolitan district of Perth. It is part of a chain of wetlands with strong biophysical similarities that extend north to south parallel to the coast in the Spearwood Dune System. The original lake basin was

essentially a marsh totalling approximately 420 ha. It was described by the early European settlers as open water with fringing rushes and fresh water paperbacks, swamp banksias and gums. Today it comprises of a variety of landscapes including permanent water bodies, seasonally dry wetlands and open parklands.

Since the arrival of the early European settlers in 1829 there have been major transformations to the wetland. The land surrounding the lake has been partially cleared and modified. Many schemes were suggested and several implemented. These include: grazing and market gardening, rubbish disposal, the site for Perth's main airport, drainage management, dissection by main roads, and development as a deep lake for boating.

From 1837 to 1848 the land surrounding the Lake was used for dairy farming, a slaughtering works and market gardening. By 1848, a government committee stated that there was no objection to draining the Lake for the reclamation of its 1 057 acres of arable land. However, this did not eventuate because of the perceived remoteness and distance from Perth.

After World War 1 the government was urged by the Returned Sailors, Soldiers and Nurses Association of Western Australia to purchase from the Roman Catholic Church 82 hectares of land and drain the Lake to reclaim the fringing land. In 1920 an Act was past to authorise the drainage of the Lake to establish market gardens across much of the low-lying drained land.

The Act was repealed in 1926. The venture proved to be uneconomical, and the Lake was allowed to refill; although vast sums of money were spent by the Government to encourage settlers to take up market gardening on the reclaimed land, the land that had been cleared was allowed to revent to reedbed and wetland.

Today the pressures of urbanisation have led to the encroachment of residential and industrial developments. Nevertheless, despite these impacts, Herdsman Lake remains an important wetland on the Swan Coastal Plain. Wetlands around the Lake embrace a variety of landscapes including permanent water bodies, and open parklands. The Lake and its surrounds are of significance as a bird breeding and summer refuge for many waterfowl, bush birds and birds of prey. Over one hundred species have been recorded, some of which are transequatorial migratory waders. In 1999 the area was designated a Regional Park. The conservation of the landscape has a strong educational focus and is inclusively conserved by the 'West Australian Gould League Wildlife Centre'.

Lake Joondalup (the largest lake in the northern suburbs of Perth) is located within the area now known as 'Yellagonga Regional Park'. The Lake is located approximately 20 kilometres north of Perth in a depression within the coastal limestone belt of the Swan Coastal Plain.

The Nyoongar developed a deep spiritual attachment to the Lake and its surrounding wetlands. It formed part of their 'Dreamtime stories' of ancestral beings, and associated with this are sites of mythological, ritual and ceremonial significance. It was an important camping site for corrobories and summer socialisation.

The first recorded journey by a European to the area was in 1834, by explorer John Butler. He submitted a written report to Governor James Stirling noting an almost pristine environment, 'a haven for wildlife'.

By 1837 several early settlers had taken up land around the Lake. However, they did not establish any permanent settlement and because of the isolation and distance from Perth. Farming was not regarded as a viable proposition. Nevertheless, despite the distance, by 1838 a small number of settlers were living and working in the area. Their main occupations were dairying and market gardening. The number of settlers increased to approximately sixty families by 1872. In 1893 the area was recorded in the *West Australian Directory* as an agricultural settlement. Settlers bought cheap land to establish 'peasant agricultural type holdings'. It became practice to burn land from around homestead sites and areas for cultivation, destroying much of the natural bushland. It clearly shows how little the early settlers appreciated the native flora and fauna.

During the latter half of the nineteenth century the farming community expanded, gradually changing the nature of the land surrounding Lake Joondalup. Permanent buildings were erected for habitation and planting of non-native crops altered the native ecosystem.

The early European settlers displaced the indigenous people. However, as the demand for housing land grew, suburban homeowners were gradually displacing the market gardeners and farmers. By 1975 land that was previously used for crop production had been re-zoned urban residential land and became part of the suburban extension. Most recent phases of development have contributed in part to the progressive fragmentation of Lake Joondalup and surrounding wetlands and its life support systems. Transformation from a sustainable use of the landscape to a resource-base, money economy. The area was designated a Regional Park in 1999.

Loch McNess is located within the area now known as Yanchep National Park. It covers an area of 2 799 hectares 50 kilometres north of Perth. It is the furthest of the wetland landscapes studied from the metropolitan area. The natural environment of the area is characterised by gentle undulating landforms mostly of sandy limestone of ancient parallel sand dunes with intervening depressions, containing wetlands.

Subterranean waterways and cave lakes occur in the area, and for many centuries numerous springs discharged from the limestone's into Loch McNess, which combined with the rich soil, produced an abundance of flora, thus providing nourishment to migratory seasonal and resident wetland species of birds and mammals.

The Nyoongar for thousands of years were well aware of the richness of the landscape and the availability of water making it a valuable camping site during the hot dry summer months. They would gather for watering, food gathering, hunting and corroborees. Stories of the 'Dreamtime' were passed around the campfire and presented in the dances at the corroboree.

Indigenous people may not have a 'science of management', Aplin (2002, p.234) states however:

> Their form of management is not through a series of written, codified rules and regulations, but through a series of unwritten religious rules and taboos passed on as part of the oral tradition from generation to generation.

The nearby limestone quarries and limekilns indicate the transformation of the landscape, and exploitation by a money economy in the late 19th and early 20th centuries. Yanchep officially became an 'A' Class reserve in 1969 and was given National Park status. Today the Park has been planted with non-indigenous trees and shrubs to create a park-like landscape for passive recreation.

After nearly a century of protection much of the Park has remained comparatively unmodified it remains a good representation of the natural landscape on the Swan Coastal Plain before early European settlement. Therefore there exist countless habitats, which are relatively protected for many species of native flora and fauna to succeed.

9.1 Review of research questions

To examine the complexity of the cultural and ecological transformations of Lake Joondalup, Herdsman Lake and Loch McNess five research questions were formulated.

These questions defined the extent of the research and were intrinsic to the research objective.

Question one: Is it possible to identify a sequence of occupancies and land use in these wetlands?

It was demonstrated that by tracing the historical sequence of landowners it was possible to identify a pattern of developments and landscape change in the study areas. The first cultural impacts to the landscapes are attributed to the Nyoongar people over 50 000 years ago (discussed in detail in chapter 3). With the arrival in 1829 of the early European settlers and with the introduction of their new concepts there have been significant transformations to the established indigenous cultural landscape.

Question two: How did the attitudes of the indigenous people compare with those of the early European setters?

Indigenous people developed a deep spiritual attachment to the natural environment deriving a sense of belonging and of oneness with all natural species and elements within their environment. As hunter-gatherers their life-style was well suited to the environment and was ecologically sustainable. In comparison, the early settlers believed they could change the Australian landscape into an ordered European-style landscape by introducing their familiar animals and land management techniques, and exploiting it via the money economy.

Question three: How did the use of the wetlands by the indigenous people and the early European settlers compare?

Indigenous people practiced a sustainable lifestyle that was well suited to their environment. Rather than modifying the land to suit them, they developed an extremely efficient system of managing the land and its natural resources. However, to augment the productivity of their food supply they did influence the environment by their fire-stick burning which had the most pervasive effect on the natural environment. In contrast, the early European settlers displayed a lack of understanding of the seasonal changes of the hydrological balance of wetland ecosystems. They believed they could change the Australian landscape by transforming the land into a landscape more familiar to them.

Question four: What were the significant changes to the wetland environment from before 1829 through to 1939?

The wetlands have experienced drastic changes to the original landscape. Since early European settlement there has been a loss of more than eighty per cent of wetlands on the Swan Coastal Plain and the remaining are heavily modified and no longer in their natural state. Before 1829 the Nyoongar did influence the environment by the use of firestick farming to increase the productivity of their food supply as discussed in (Chapter 4). Nevertheless by developing an extremely efficient system of managing the land and its natural resources, the Nyoongar maintained the landscapes ecological balance.

However, the fundamental difficulty the early European settlers faced was to obtain land, which was of some practical use as much of the land was unsuitable for agriculture. The settlers believed they could change the Australian landscape into a familiar European style landscape. Before cultivation was possible large areas of land had to be cleared which degraded much of the natural landscape. The function of the land was to change significantly and with it the nature of the landscape. Introduced cattle, sheep and horses destroyed the ground cover limiting the amount of grazing land needed by the native fauna and flora. Also the introduction of exotic species of shrubs and trees out-competed native species on which the Nyoongar relied.

Question five: What can be learnt from traditional indigenous land use in terms of sustainable practice?

Some aspects of the traditional management practiced by the Nyoongar as discussed by early explorers and early European settlers and provided in this study provide insights for contemporary sustainable management. The Nyoongar developed a pattern of life that was well suited to their environment. It was established on a detailed awareness of nature and elements within their milieu. They established techniques for conserving food resources by traditional harvesting practices, which was handed down from generation to generation. Their economy was a subsistence one, gathering sufficient food for their immediate use without causing the depletion of the natural valuable resources. They maintained the landscape's ecological balance, by subtle intermittent use of fire.

It is essential that the remaining wetlands on the Swan Coastal Plain are maintained and protected. However, when enhancing the aesthetic and recreational

values of wetlands the effects are sometimes detrimental to its value. Therefore, buffer zones are an effective solution in managing the impacts of urbanisation. They provide a vegetation screen which blocks urban encroachment and allow a range of native vegetation associations to be re-established. Wildlife corridors also enhance wildlife conservation in disturbed environments and assist animals in their movements through the landscape, and provide shelter, nesting sites and refuge for native fauna.

However, today the boundary effects on the study areas from surrounding urban development pose significant challenges. Future exacerbation by impending climate changes, the general lack of rainfall and water going into wetlands, also encroachment of urbanisation are detrimental to the fragile wetland ecosystem. Due to the complexity of interactions between land use and water resources it requires a high level of technical expertise (Environmental Protection Authority, 1989). The managing of wetlands requires integration of planning proposals in both the local and regional context, which is acceptable to the public and achievable by local government. This will require ongoing community participation and appropriate government and local authority involvement and the intervention with a time scale of far-reaching decisions that extends well beyond the immediate future.

Most importantly, there should also be equal participation by indigenous people to seek a balance between natural values, indigenous significance and the value of the developed areas. According to their traditional laws indigenous people have a strong desire to ‘care for country’. Therefore it will be beneficial to the protection of natural and cultural heritage, as well as enriching cross-cultural awareness. The decisions made now will determine the state of their inheritance that extends well beyond the immediate future. They should be, and, are included in the planning of current land-management procedure.

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The West Australian 10th March 1902.

The West Australian 2nd April 1921.

The West Australian 20th December 1922.

The West Australian 7th March 1931.

The West Australian 27th August 1931.

The West Australian 21st December 1931.

The West Australian 13th April 1933.

The West Australian 13th July 1933.

The West Australian 25th November 1935.

The West Australian 4th October 1936.

The West Australian 14th October 1936.

The West Australian 9th April 1937.

The West Australian 25th June 1937.

Western Mail 17th October 1908.

Western Mail 7th August 1924.

Western Mail 5th January 1928.

Western Mail 22nd January 1931.

Appendix 1:
Aerial Photographs
Herdsman Lake, Lake Joondalup, Loch McNess

Approx scale: length of Lake 2.1 kilometres ↑N

Figure 36: Herdsman Lake 2009.
Source: Landgate Western Australian Land Information.

Although there is a high proportion of residential and industrial encroachment on the shores of the Lake there still remains open parkland designated for recreational purposes. The dominant and most productive species in the native vegetation is the bulrush (*Typha orientalis*), beds of which can be clearly seen on the map in the centre of the Lake. The Lake and surrounding wetland support a diversity of wildlife species and constitute and important wetland of the Swan Coastal Plain. Walk tracts enable the public to enjoy the beauty of the wetlands.

Approx scale: length of Lake 6 kilometres ↑N

Figure 37: Lake Joondalup 2009.
Source: Landgate Western Australian Land Information.

Market gardens around the shores of the Lake that were previously used for crop production have been re-zoned urban residential land, and have become part of the suburban extension clearly shown on the map surrounding the Lake. However, there still remain beds of reeds and a fringe of paperbarks, which provide shelter, nesting sites and sustenance for a diversity of wildlife species. Open parklands along the shores of the Lake have been designated for recreational purposes. Cycle tracks and walkways enable the public to observe and appreciate the natural beauty of the wetlands.

Approx scale: length of Lake 1.6 kilometres ↑N

Figure 38: Lake Goollelal 2009.
Source: Landgate Western Australian Land Information.

There is low density of urbanisation around the shores of the Lake. Large areas of open land can be clearly seen, and are designated for recreational purposes. The surrounds of the Lake provide habitats for a diversity of bush birds and are ideal nesting sites numerous waterbirds. Cycle tracks, walkways and natural trails lead people along well-defined routes, to reduce disruption to existing vegetation.

Approx scale: length of Lake 1.5 kilometres ↑N

Figure 39: Loch McNess 2009.
Source: Landgate Western Australian Land Information.

Loch McNess has remained relatively unmodified, which is now rare amongst the wetlands of the Swan Coastal Plain. Dredging modified and deepened the southern end of the Lake and created artificial islands, which can be clearly seen on the map. The fringing species communities provide sustenance and a safe haven for migratory seasonal and wetland species of birds and mammals. Open parklands along the shores of the Lake have been designated for recreational purposes.

Appendix 2:
Waterbirds
Herdsman Lake, Lake Joondalup, Loch McNess

Wetlands provide an important habitat for many waterbird species. Listed below a small proportion of birds that can be found in the wetlands surrounding Herdsman Lake, Lake Joondalup, Lake Goolellal and Loch McNess:

Australasian grebe (*Tachybaptus novaehollandiae*)
Australian shelduck (*Tadorna tadornoides*)
Australasian shoveler (*Anas rhynchotis*)
Black swan (*Cygnus atratus*)
Black-winged stilt (*Himantopus himantopus*)
Blue-billed duck (*Oxyura australis*)
Clamorous reed-warblers (*Acrocephalus stentoreus*).
Dusky moorhen (*Gallinula tenebrosa)*
Eurasian coot (*Fulica atra*)
Great crested grebe (*Podiceps cristatus*)
Grey teal (*Anas gracilis*)
Hoary-headed grebe (*Poliocephalusa poliocephalus*)
Little bittern (*Lxobrychus minutus*) breed prefers dense stands of *Typha orientalis*.
Little grassbird (*Megalurus gramineus*)
Little pied cormorant (*Phalacrocorax melanoleucos*)
Magpie Lark (*Grallina cyanoleuca*)
Musk duck (*Biziura lobata*)
Nankeen night heron (*Nycticorax caledonicus*)
Pacific black duck (*Anas supercilious*)
Pink-eared duck (*Malacorhychus* membranaceus)
Purple swamphen (*Porhyrio porphyrio*)
Red-kneed dotterel (*Erythrogonys cinctus*)
White-tailed Black Cockatoo (*Calyptorhynchus baudinii*)
Yellow-billed spoonbill (*Platelea flavipes*)
(Department of Conservation and Land Management, 1989-1999).

Appendix 3:
Photographs
Birds of the Wetlands

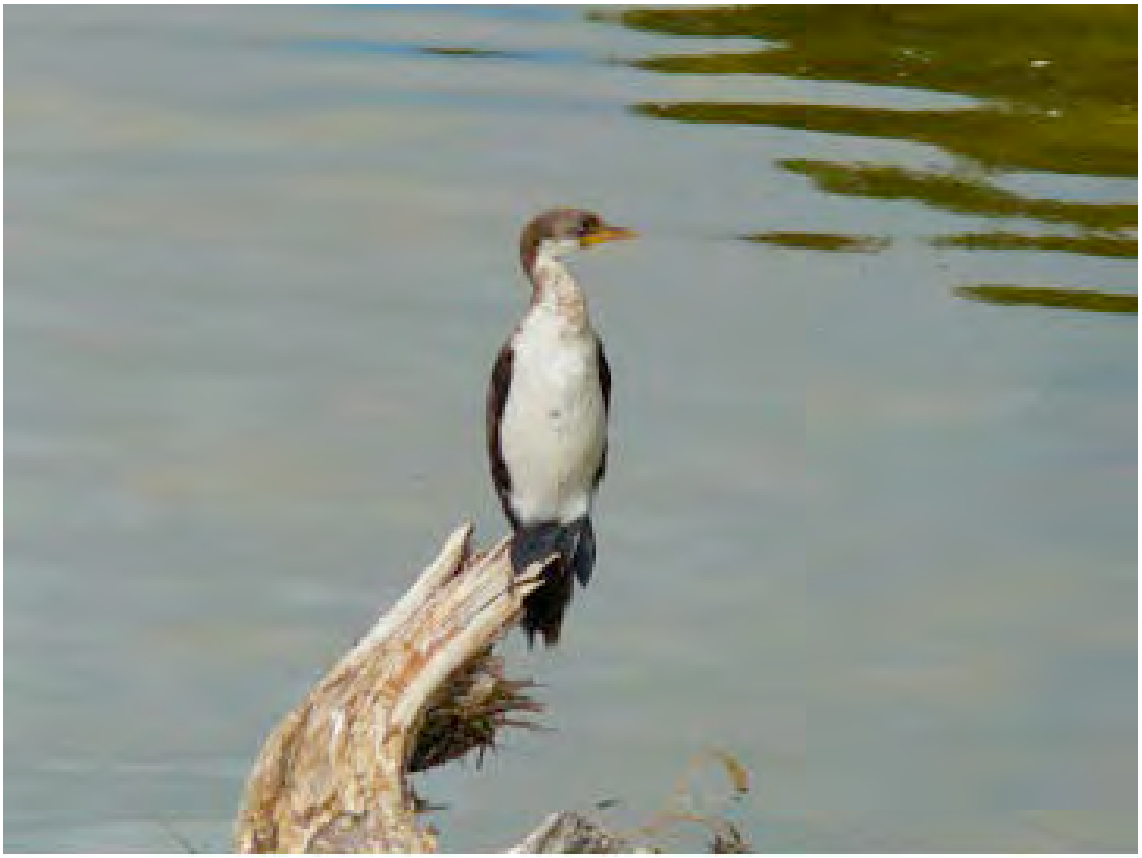

Figure 40: Little pied cormorant (*Phalacrocorax varius*).
Source: Gary Tate.

Figure 41: Blue-billed duck (*Oxyura australis*).
Source: Gary Tate.

Figure 42: Blue-winged shoveller (*Anas rhynehotis*).
Source: Gary Tate.

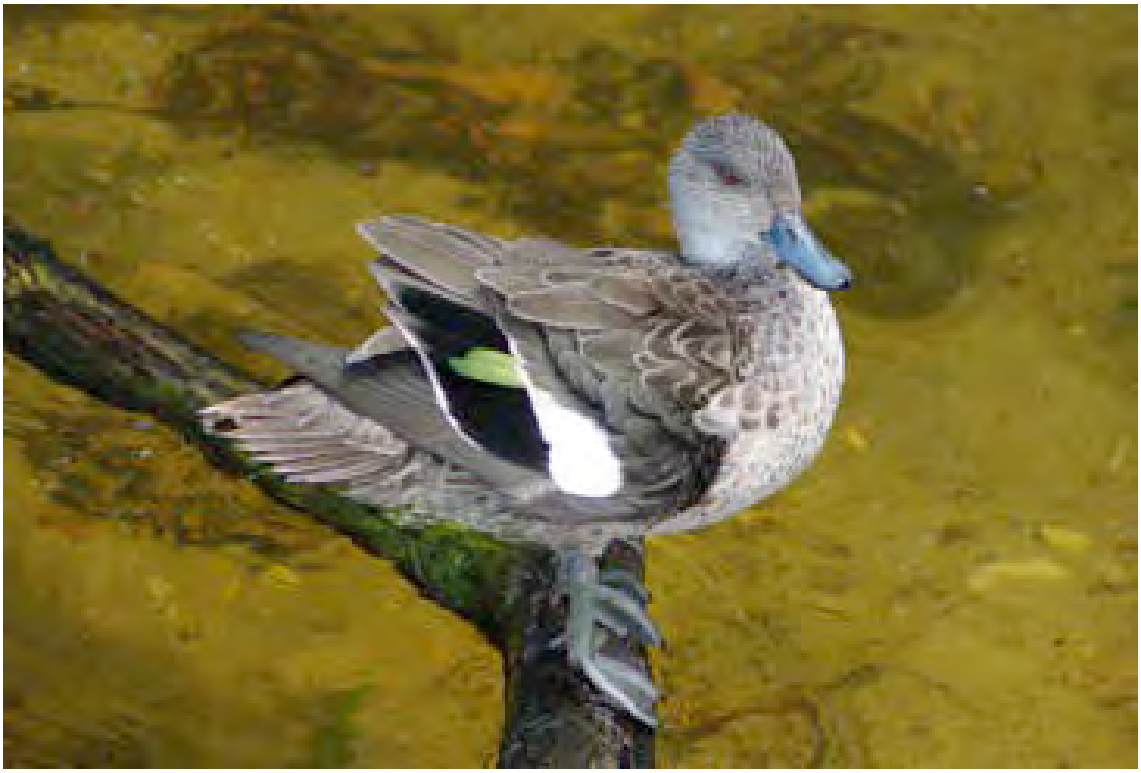

Figure 43: Grey Teal (*Anas gracilis*).
Source: Gary Tate.